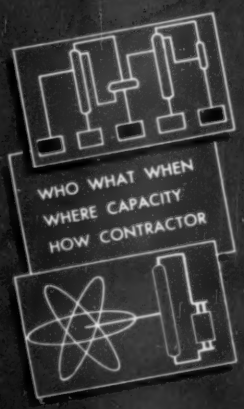
the OIL AND GAS JOURNAL

MARCH 25, 1957



Process Diagrams
Refinery Survey
Radioactive Processing

Annual Refining Number

Refiners' Story: More Capacity, Better Quality • p. 102
Secondary Recovery Becomes a Must in Pembina • p. 110
Big Bankrolls Ride on Venezuelan Concessions • p. 118

2" and 4" Fig. 22945 Rockwell-Nordstrom "Mudline" 3000-lb WOG valves on mud manifold.

Why bother with replaceable seat valves?

SPECIFY THE VALVES WITH UNEXPOSED SEATS

At best, valve seat replacement is a costly operation in terms of parts, down time and labor. But, when you specify Rockwell-Nordstrom valves, seat wear is eliminated. Unlike ordinary valves, the seats in Rockwell-Nordstrom valves are *never* exposed to the line . . . they can't be cut or wire-drawn like the exposed seats on ordinary valves.

Unexposed seating is not the only reason why Rockwell-Nordstrom valves have been used and approved in oil fields all over the world for more than forty years. The extra benefits: *trouble-free operation* because they are lubricant sealed for really positive shut-off . . . *greater safety and dependability* because the plug can be hydraulically jacked for instant, quarter-turn operation . . . and, they always *stay in service longer at lower cost* because lubrication is preventive maintenance.

Rockwell-Nordstrom drilling and production valves are available in semi-steel, steel and stainless steel in sizes to 4" and pressure ratings to 10,000-lb WOG. Also, valves with special hard faced plugs and bodies available if desired. For complete information, see your nearest oil field supplier or write: Rockwell Manufacturing Company, Pittsburgh 8, Pa. *Canadian Valve Licensee:* Peacock Brothers Limited.

ROCKWELL-Nordstrom VALVES

Lubricant Sealed For Positive Shut-Off

JOURNAL News Letter

March 25, 1957
Tulsa, Oklahoma

Dear Sir:

You may expect air drilling to spurt into greater use soon. One of the major disadvantages of the technique--striking water sands--now may have been overcome. Researchers for a major oil company claim they have found a way to seal off the water zones in air-drilled wells. News on the development is expected to break within 30 days. Only delay now is completing details on patents covering the method.

Best tip Europe's oil crisis is over: Some American oil is going begging on the European market.

This startling information has been handed Texas Railroad Commission by representatives of majors exporting for the oil lift. Testimony also indicated crude stocks already are piling up again in Texas--not only in the West Texas trouble area but also on Gulf Coast.

That's the big reason behind commission's quick action in choking off production for April. It set Texas April allowable at 3,564,665 bbl. daily based on a 16-day flow pattern. This means a cut of 224,710 bbl. daily from the March 16 allowable flow.

The OIL LIFT, however, may continue longer than at first expected. Emergency movement will continue through April--it could last through summer. Reasons: Rising dispute between Egypt and the West over Suez Canal tolls and explosive situation between Egypt and Israel. Technical opening of the canal, it now appears, won't break up present emergency system until the toll dispute is settled. It's still too easy for Nasser to shut the canal for Europe to return to depending on Middle East oil.

The score has been toted up on oil's performance in 1956. The result: Only a fairly good year. The joint annual report of American Petroleum Institute and American Gas Association on oil and natural-gas reserves shows:

...Oil--new crude found totaled 2.97 billion barrels. This is 104 million more than found in 1954 and 1955. But production of 2.55 billion barrels during year cut additions to reserves to net gain of 422.5 million barrels.

...Natural gas--gained 14.1 trillion cubic feet sending reserves to 237.8 trillion cubic feet, largest gain ever recorded.

...Natural-gas liquids--809.8 million barrels found to top all records. But production of 345 million barrels cut addition to reserves to net 463.8 million barrels.

Although the gain in crude reserves is lowest on record, there's one encouraging factor: Geologists claim a new discovery cycle actually started in 1956. In fact, they may have found more oil than in any year since 1952. But this won't be reflected in reserves for another year or two.

Oil industry can count on one thing from new Mobilization Boss Gordon Gray: He won't order a wholesale overthrow of Flemming's policies on oil.

Gray has told Washington newsmen he has no preconceived ideas on the oil imports problem, adding: Where situations change it may be necessary to change directions. He's not expected to reach any decisions soon on imports, the first hot issue coming up. Reports of importing companies on their programs were only filed last week. ODM staff is now totaling the figures for Gray to see.

Other Washington news currents: Move may be underway to lease government shale-oil demonstration plant at Rifle, Colo., to private industry. Rep. Carl Vinson of Georgia has told Navy officials he highly favors such a research program into shale oil. He opposes Navy's plan of conducting research through a contractor at $14 million cost over 5 years. Eisenhower administration dropped shale research 2 years ago, now seems ready to pick up pieces and start again. Navy and Interior Departments both want to handle job. The Navy holds 22.5 billion barrels of shale-oil reserves and is looking toward it as source of war fuel. ...Justice Department is investigating aspects of Humble-Freeport Sulphur deal to develop huge sulfur deposits off Louisiana on 50-50 basis. Senator O'Mahoney challenges arrangement as economic concentration.

PRODUCTION men will be interested in what's going on in Canada's big Pembina field. Alberta Petroleum and Natural Gas Conservation Board is cracking down in effort to get fieldwide repressuring under way. It has given operators until April 1 to file plans for water or gas injection projects (P. 110).

Prospects are that by late this year the tremendous field will replace venerable East Texas as the world's biggest pressure-maintenance operation. Pembina generally is fast losing valuable bottom-hole pressure. Engineers report pressure maintenance work must be underway within 2 years. That explains the rush.

Group of operators headed by Canadian Seaboard already has a full-scale hot water flood started. Pumping plants and meter stations have been built despite the hard Canadian winter. Lines have been wrapped and buried and half of the 176 producing wells converted to injection service. Program will be fully developed by midsummer. Other operators are now joining the project.

The ultimate payoff for Pembina: 265,000 acres of the field flooded to recover a staggering 1,770,000,000 bbl. of extra oil.

Here's the offshore DRILLING picture 10 years down the road as seen by U. S. Steel:

...Completion of 1,200 wells a year compared with estimated 570 this year.

...Production of 780,000 bbl. daily--this would be 8 per cent of nation's output. Production in the gulf only hit about 80,000 bbl. daily or 1 per cent in 1955.

...Tubular-goods needs averaging 370,000 tons a year. This will be 10 per cent of all oil-country tubular goods production. Offshore operators only took 86,000 tons or 3 per cent of national output in 1955.

EXPLORATION people are still trying to find out who got what in Venezuela's latest concession merrygoround. Latest rundown on the winners with maps is found on page 118. Confirmation on the grants is just now trickling out of Caracas. But this much appears certain: Only about 40 per cent of the tracts attracted bidders...Price tags were too high. Bonuses may reach $400 million, more than the minimum bids set for entire offering...Gulf of Paria emerged as Venezuela's third big play area along with Lake Maracaibo and Barinas...Drilling on most concessions is many months off. Operators have to survey their new grants and scramble for drilling equipment.

Other exploration notes: Venezuelan Atlantic and Pancoastal have completed first test on eastern Venezuela's newest trend. Their Caro 1 flowed 1,185 bbl. daily through 1/4-in. choke from two zones. Well offsets Aguasay 3 discovery of Sinclair and is located near western edge of 13,411-acre San Jose de Guanipa concession---Signal Exploration is preparing to begin drilling on its 27,000 acre block in Lake Maracaibo in May...Cataract Mining of New York will start exploration work on its concession in Chirique area of Panama's Pacific Coast...Champlin Oil currently is making seismograph survey of its Panama offshore holdings in Boca del Toro Bay...Thomas Jordan, Inc., New Orleans, is getting ready to explore 250,000 acres in Cumberland basin area of Nova Scotis...Utah officials are moving to clear up land dispute with federal Government. Both are claiming the minerals on some land within Navajo Indian reservation in oil-rich southeastern Utah. State wants to clear up title before oil actually is found on the 2,700 acres involved.

PIPELINE Activity is picking up. There's talk of new lines, expanding oil ones and the perennial problem of distress oil.

The stage is all set for the April 1 showdown hearing in Austin on lack of pipeline capacity out of North and West Texas to the gulf. Most pipelines have complied with Railroad Commission order for detailed data on their operations. Commission staff is wading through the stuff. Some observers believe pipelines will be on the spot to show why they shouldn't expand capacity of lines to make market for oil from 8,000 unconnected wells.

Distress oil problem also is cropping up in southwestern Kansas and northwestern Oklahoma. Normal market is being shut off by Shamrock Oil & Gas which has commitments for Texas oil. Southern Kansas Pipeline has been organized as result. It hopes to build 200-mile, 6 to 10-in. line to near Arkansas City to move 10,000 bbl. daily of the crude. Most would go to Oklahoma refiners--rest to Chicago. Possibility of line north from distress area to tie in with Arapahoe line also is being talked.

Corrosion engineers are showing greater interest in new plastic tapes for protecting pipelines. Companies which have not taped any lines are eagerly comparing their performance against conventional asphalt and coal-tar coatings and wrapping materials. One deterrent to plastic tapes: Management is

slow to use a product for which there are no minimum standards. It fears law suit in case there's an accident on a taped line. The standards problem will be corrected soon.

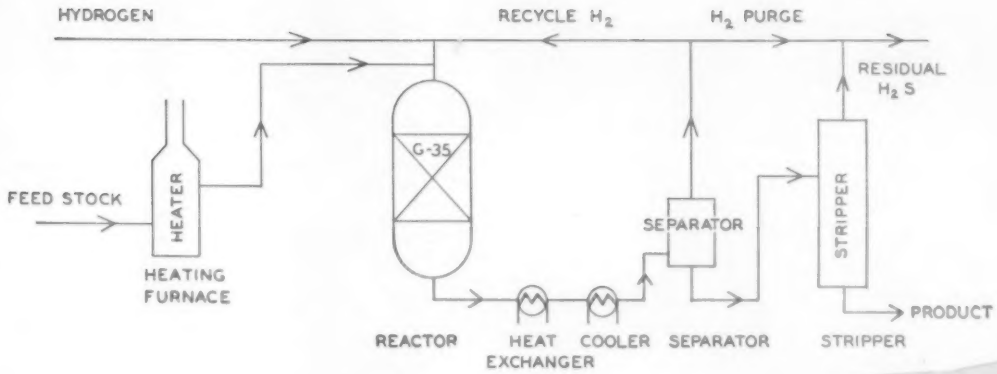
Projects: Gulf-East Coast emergency oil line got blessing of Flemming before he retired. He termed American Pipeline's proposed 500,000 bbl. line desirable from defense standpoint. It would move products in peace and crude in emergency. More important, Flemming turned down competing proposal of Texas Eastern Transmission to convert Little Big Inch gas line to crude. This does not involve Texas Eastern's plan to convert Little Inch to products. This is still before FPC. American now is moving to qualify itself for government financial help... Plans for huge Laurel products line (Gulf-Sinclair) westward from Philadelphia refining area into Ohio are progressing. The 20-24-in. line once planned for extension to Cleveland now may stop at Youngstown... First survey crews have started work over route of 600-mile Four Corners pipeline to Los Angeles... Work also has started on 100 miles of 30-in. looping on Trans Mountain... Texaco has started laying a 10-in. crude gathering system in its area of Aneth field in southwestern Utah... Transcontinental has let contract to Western Construction for 110 miles of 30 and 36-in. loops along its system in the Carolinas, Pennsylvania, and Virginia... Talk of a new crude line out of the Williston basin is growing as reserves further outstrip capacity of present facilities.

One interesting fact for REFINERS in The Journal's annual refining survey this week is this: Independent refiners are holding their own in most areas with the big majors in making high-octane gasoline and quality products. Actually, some small refiners are industry leaders in this respect. For the full story on rise in crude capacity and trends in new processes see page 102.

Refiners shipping on the Great Lakes Pipe Line now are considering a a proposal to increase octanes of gasoline by 1 number. This would push regular to 89 and premium to 97. No decision is expected before late May. An earlier proposal to jump premium by 2 numbers and regular by 1 was voted down.

Deal is in the making to alter conditions governing sale of U.O.P. to satisfy objections of independent refiners. They oppose sale on grounds it will hurt them. So these two terms now may be applied to the sale: Ownership of U.O.P. will be spread among a number of stockholders with no single company getting dominance... U.O.P. services now available to licensors will be continued.

REFINING PROJECTS: Cal-Mex Oil & Refining, West German owned firm, is shopping around for refinery site in San Diego, Calif. It plans 20,000 bbl. plant costing $27 million with full facilities for 100-octane gasoline... Sun will spread its superpremium fuel outside the Florida test area next month .. Atlantic plans to start work on new alkylation unit at Port Arthur, Tex. refinery... Kentucky's first Platforming and Unifining units are now on stream as combination facility at Louisville... DuPont's first tetraethyl lead plant west of Rockies is now on stream near Oakland... First large-scale quantities of Marlex 50 have started moving from Phillips Chemical Co.'s big Adams Terminal Plant on Houston ship channel.



Naphthas, middle distillates, gas oils and lube stocks can all be upgraded by hydrogen treating with the use of new Girdler G-35 catalysts. These highly active cobalt molybdenum catalysts were developed specifically for the desulfurization, denitrification and stabilization of petroleum feedstocks covering a wide molecular weight range. Typical flow diagram is shown.

Check these outstanding benefits of G-35 hydrogen-treating catalysts

G-35 HAS OUTSTANDING PHYSICAL PROPERTIES — these are retained even after extended use. Permit outstanding operational flexibility, continuous economical operation with essentially 100% yields.

IMPROVEMENT OF COLOR stability, lead susceptibility, burning characteristics and the removal of poisons from catalytic reforming feedstocks are among the more important results achieved. Girdler's expanded production facilities are geared to meet your needs for G-35 catalysts.

DETAILED INFORMATION is available on G-35 catalysts. Bulletin GC 304 discusses applications, gives process conditions for various distillate stocks, performance features and typical catalyst specifications. Free on request.

CATALYST DEPARTMENT

The GIRDLER Company

A DIVISION OF NATIONAL CYLINDER GAS COMPANY

LOUISVILLE 1, KENTUCKY

GIRDLER MANUFACTURES CATALYSTS FOR: HYDROGENATION • SYNTHESIS GASES AND HYDROGEN GENERATION • DESULFURIZATION • NEW CATALYTIC PROCESSES

the OIL AND GAS JOURNAL

MARCH 25, 1957 • VOLUME 55 • NUMBER 12

THE STAFF

TULSA OFFICE
211 South Cheyenne Ave.
Phone Diamond 3-6291

Kenneth B. Barnes ... Editor
Henry D. Ralph ... Chief Editorial Writer
Ted A. Armstrong ... News Editor
Gerald L. Farrar ... Engineering Editor
Dr. Frank J. Gardner ... Exploration Editor
Paul Reed ... Pipeline Editor
John C. Reidel ... Petrochemical Editor
C. O. Willson ... Consulting Editor
W. L. Nelson ... Technical Editor
Lynn M. Nichols ... Presentation Editor
John C. Casper ... Economics Editor
Neil Williams ... Associate Editor
Norman S. Morrisey ... Drilling-Development Editor
Carl J. Lawrence ... Assistant News Editor
Gene T. Kinney ... Assistant Pipeline Editor
R. B. Tuttle ... Equipment Editor
Bill Linville ... Assistant to Presentation Editor
Carl Hoot ... District Editor
John C. McCaslin ... District Editor
W. A. Bachman ... District Editor
J. O. Scott ... District Editor
J. C. Bradford ... District Editor
Robert B. Bizal ... District Editor
Sara Bangert ... District Editor
LaWanda Turner ... Readership Research
Helen Brown ... Editorial Assistant
Alice Burt ... Editorial Assistant
Aileen Cantrell ... Editorial Assistant
C. Dudley Johnston ... Art Director
Jo Jeanne Speaker ... Staff Artist

NEW YORK OFFICE
500 Fifth Avenue
Phone LOngacre 4-6160

George H. Weber ... Refining Editor
Paul Swain ... International Editor
Ray G. Gibson ... District Editor
John P. O'Donnell ... District Editor

HOUSTON OFFICE
802 Sterling Building
Phone CApitol 4-7726

Larry Reisen ... District Editor
Ed McGhee ... District Editor
Joe Reilly ... District Editor

DALLAS OFFICE
1238 Mercantile Building
Phone Riverside 8-3074

Robert J. Enright ... District Editor

LOS ANGELES OFFICE
650 South Grand Avenue
Phone VAndike 0722

D. H. Stormont ... District Editor
William T. Smith ... District Editor

WASHINGTON OFFICE
621 Albee Building
Phone District 7-1710

Bertram F. Linz ... District Editor

Correspondents at Denver, Pittsburgh, Calgary, Columbus, Ashland, Ky., Oil City, Pa., Mount Pleasant, Mich., Melbourne, Australia; Regina, Sask.; Chatham, Ont.; Casper, Wyo., and Anchorage, Alaska.

The Oil and Gas Journal, Published Mondays, copyright 1957, by The Petroleum Publishing Co. Entered as second-class matter September 1, 1910, at post office at Tulsa, Okla., under act of March 3, 1879. United States and foreign rates to the petroleum industry, 1 year $4, 2 years $7, 3 years $8.

IN THE NEWS

General Interest:

Top Industry Men Preview Stocks and Imports ... 99
Gray Will Stick with Flemming's Policies ... 112
Aramco Under Fire for Dwindling Tax Payments ... 117
New Venezuela Awards May Bring $400 Million ... 118

Production:

Texas Oil Goes Begging in Western Europe ... 101
New Gas-Liquid Reserves Outstrip Crude ... 108
Alberta Pushes Big Pembina Recovery Program ... 110
Humphrey Warns Against Changing Depletion Allowance ... 115

Processing:

Refining Capacity and Quality Are on the Upswing ... 102
Independents Reported Near Agreement on U.O.P. Sale ... 106
Strike Vote Looms at Four Major California Plants ... 113
West German Firm Planning Refinery Near San Diego ... 115

Pipelining:

Stage Set for Texas Pipeline Showdown Hearing ... 101
Flemming Gives Parting Boost to Emergency Crude Line ... 112
Outlet Set for Distress Kansas Crude by New Company ... 114
World Oil Leaders Exploring Mid-East Outlets ... 117

Exploration:

U. S. Steel Sees Lush Future Off Gulf Coast ... 107
Mene Grande Says Lake Maracaibo Strike Promising ... 119
Combine to Test '56 Lake Maracaibo Lease in May ... 120
Ethiopia Search Fails, Sinclair Pulls Out ... 120
Deep Test Hits on Eastern Venezuela's New Trend ... 120
Perfect Structure in Webb County, Texas, Gets Deep Test ... 287
Paradox and Offshore Tagged as Nation's Best Bets ... 288
Tennessee Development Picks Up ... 300

"Oil Hits Back" Still Available

"Oil Hits Back" has made a big hit. Orders are pouring in for reprints of this special section, which appeared in last week's Journal. But copies are still available. Price is 20 cents for single copies. Quotes will be made on larger orders. The 16-page special section has all the hard-hitting, easy-to-read facts needed to defend the industry against critics. Order from:

Reader Service Department
The Oil and Gas Journal
Box 1260, Tulsa

OIL AND GAS PIPELINES • REFINING • PETROCHEMICALS
EXPLORATION • DRILLING • PRODUCTION • FIELD PROCESSING

. . . an integrated magazine serving an integrated industry

SPECIAL REFINING SECTION

Special Process Section: Processing in Today's Refineries 121-168

Here are flow sheets and flow descriptions of 48 selected processes for today's refining needs.

Bottom Of The Barrel 122

Four of the processes have to do with higher recovery from the bottom of the barrel. These include coking and decarbonizing.

Catalytic Cracking 126

This group includes seven cracking processes and one for extraction of cycle gas oil.

Catalytic Reforming 134

Ten of the processes are devoted to catalytic reforming. Two of these provide for reprocessing to higher octanes.

Hydrogen Treating 143

There are nine processes for removal of sulfur and other impurities by hydrogen treating.

Isomerization 153

With higher octanes and sensitivities required of gasolines, seven processes are available to isomerize various stocks.

Alkylation 160

The refiner can select from six processes to meet his alkylation needs.

Polymerization and Others 166

Two polymerization processes, one on urea dewaxing, and one on selective diolefin hydrogenation round out the process section.

Annual Survey of Capacities of Operating Refineries 170

The Journal's annual survey of operating refineries shows that United States capacities were boosted to nearly 9,600,000 bbl. per stream day by January 1, 1957. All figures in the capacity table are of this date. Additions during 1957 and later can be made to the basic table by consulting the new construction table. Other capacities for U. S. refineries are: (1) vacuum distillation, 2,623,000; (2) thermal operations, 2,328,000; (3) catalytic cracking, 3,999,000; (4) catalytic reforming, 1,245,000; (5) hydrogen treating, 796,000; (6) alkylation, 273,000; (7) polymerization, 134,000; (8) lubes, 183,000; and (9) asphalt, 412,000 bbl. per day. Coke capacity was 14,400 tons per day.

Shutdown U. S. Plants 212

Refineries in Mexico 212

Survey of New Refinery Construction 204

There will be increases all along the line in refining capacity during 1957. Biggest jumps percentagewise will be in catalytic reforming and hydrogen treating, especially the latter. Alkylation capacity will go up significantly also. The emphasis will be on increase in quality, rather than increased throughput. This section gives the project-by-project details, with contractor and cost figures when they're available.

What's Ahead in Radiation Processing 213

Here are statements by eight well-known authorities which summarize where we are and show us where we might be going in this new field.

TECHNOLOGY-OPERATION

Refiner's Notebook 225

Field Processing 227

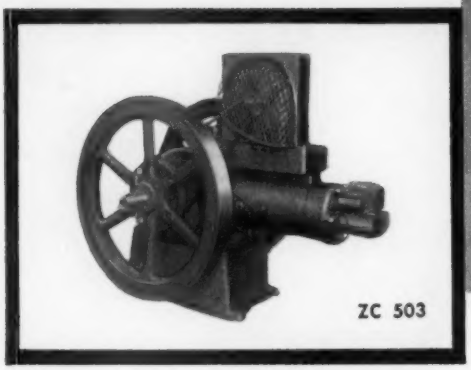
Pipeline Patrol: Coal Slurry Pipeline in Operation 228

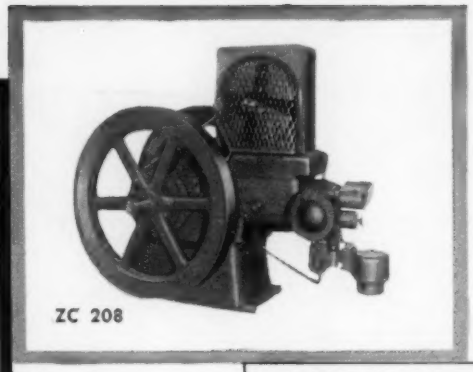
By Fred Culpepper

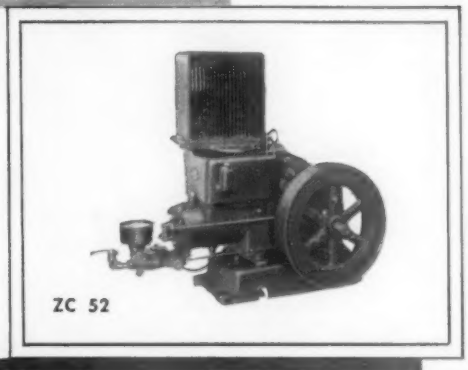
This 110-mile line runs from Cadiz, Ohio, to the East Lake plant of Cleveland Electric Illuminating Co. on Lake Erie, east of Cleveland.

DEPARTMENTS

They Say	89	Field Processing	227	Statistical Summary	328
Calendar of Events	90	Pipeline Patrol	228	Drilling Statistics	329
Journally Speaking	93	Drilling Contractors	233	Supply Statistics	330
Editorial	95	Equipment Digest	257	Refining Statistics	331
Watching Washington	113	Equipment Men in News	271	Markets	332
International News	117	Exploration Highlights	287	Classified Advertising	334
Refiner's Notebook	225	Personals	325	Advertisers' Index	339


ZC 503


ZC 208

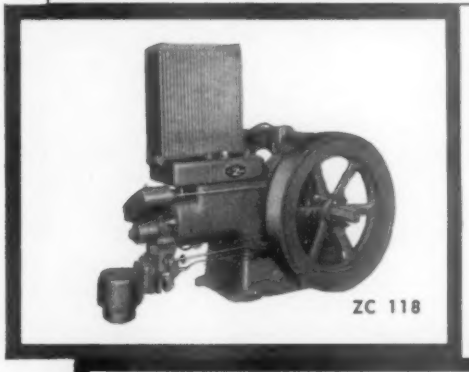

ZC 52

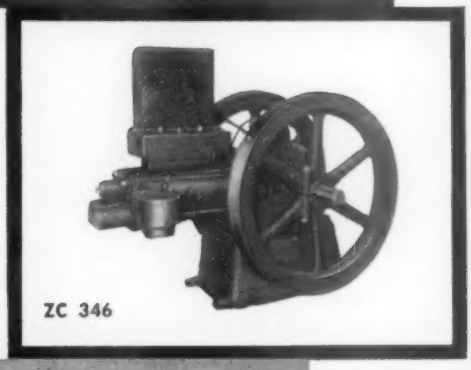
pick a "ZC" that best fits your pumping unit!

The broad Fairbanks-Morse "ZC" line has an engine that will best fit your pumping unit . . . from 3 to 30 hp. They're economical and easy to maintain—simply designed with no complicated parts or delicate adjustments.

All "ZC" sizes are high displacement, heavy-duty, slow-speed models—ideal for oil field pumping service! And, all sizes have the famous extra-heavy double flywheel for symmetry and perfect balance . . . with power take-off on either side of the engine.

See your local supply store about the "ZC" line . . . or write Fairbanks, Morse & Co., Chicago 5, Illinois.


ZC 118


ZC 346

FAIRBANKS-MORSE

a name worth remembering when you want the best

OIL FIELD EQUIPMENT • PUMPS • SCALES • GENERATORS
ELECTRIC MOTORS • LIGHT PLANTS • DIESEL, DUAL FUEL &
GASOLINE ENGINES • MAGNETOS • DIESEL LOCOMOTIVES

ZC 739

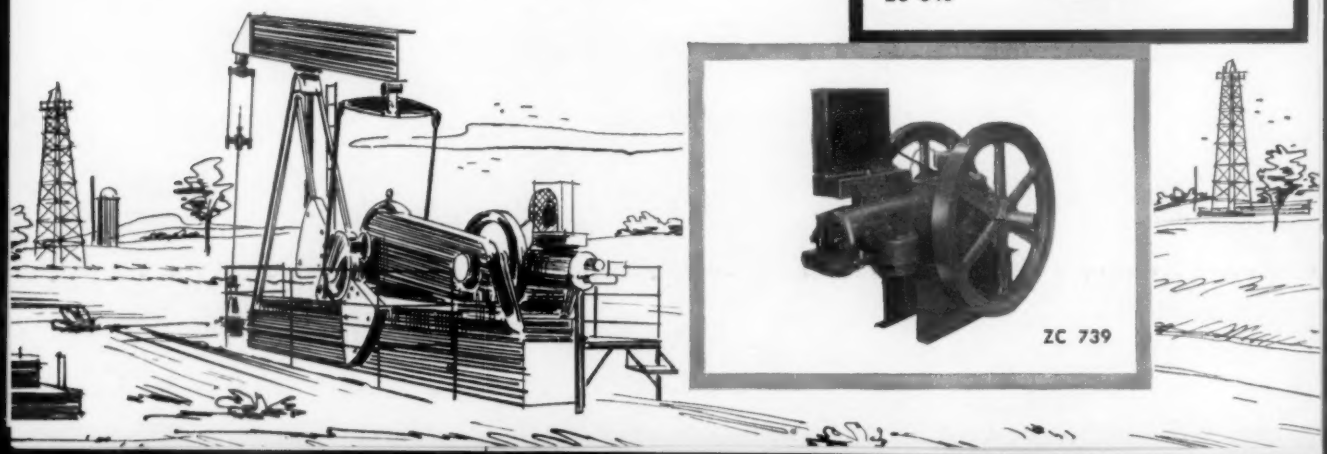
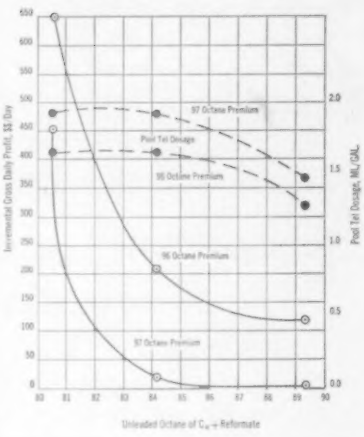


TABLE I
Economic Study of Catalytic Reforming Operations

Reformer Operation	Design	Lo Level	Hi Level	Down
C_4+Product Clear Research Number	84.2	81.1	89.3	Jet Fuel
Pool TEL Dosage Ml./Gal. Premium Octane Level	1.625/1.895 96/97	1.65/1.92 96/97	1.275/1.44 96/97	2.685/2.97 96/97
Product Realization, $/CD	38880	39205	38625	30885
Variable Costs, $/CD				
96 Premium	2965	2850	2805	2965
97 Premium	3160	3045	2920	3125
Net Gross Realization, $/CD				
96 Premium	35915	36355	35820	27920
97 Premium	35720	36160	35705	27760
Incremental Gross Profit, $/CD				
96 Premium	210	650	115	
97 Premium	15	455	0	
Jet Fuel Break-Even with Best Performance Case, $/CD				
96 Premium—11.2c/Gal.				8435
97 Premium—11.1c/Gal.				8400

FIGURE I
Economic Study of Catalytic Reforming Operations



A SMALL REFINER'S PROFIT GOES UP $400 PER DAY! Du Pont's economic study recently helped a progressive refiner realize optimum performance with a newly installed catalytic reformer. Three operating conditions were compared—low-level, design, and high-level severity. Two premium gasoline octane levels, as well as jet fuel production, were considered. The above table and graph (right) pointed up the proper severity level for the refinery being studied.

These charts show how Du Pont helped a refiner ...get higher octane at lower cost

The demand for higher-octane fuels places new and increased importance on the question: How can those extra octane numbers be achieved at lowest cost?

This subject has often come up for consideration at Du Pont, especially during analyses of refinery operations and the effect of these operations on tetraethyl lead requirements.

A Du Pont service

As a result of the knowledge and experience gained in this way, our technologists have been able to help a number of refiners cut octane-improvement costs.

You can call on Du Pont to work with your own staff to develop more economical ways of boosting octane levels, or to confirm the findings of your group. Or you may prefer to have our technical representatives consider your facilities and make recommendations to fit your individual needs.

In any case you need only contact the nearest Petroleum Chemicals Division office listed at right.

SALES OFFICES

Chicago 3—8 So. Michigan Ave. ..... RAndolph 6-8630
Cleveland 15—25 Prospect Ave. ..... SUperior 1-1363
Houston 2—705 Bank of Commerce Bldg. CApitol 5-1151
Los Angeles 17—612 So. Flower St. ... MAdison 5-1691
New York 20—1270 Ave. of the Americas ..... COlumbus 5-2342
Philadelphia 2—3 Penn Center Plaza ... LOcust 8-3531
Pittsburgh 22—1 Gateway Center ..... ATlantic 1-2933
San Francisco 4—111 Sutter St. ..... EXbrook 2-6230
Seattle 3—4003 Aurora Ave. ..... MElrose 6977
Tulsa 1—1811 So. Baltimore Ave. ..... LUther 5-5578
In Canada—Du Pont Company of Canada (1956) Limited, Petroleum Chemicals, 85 Eglinton Ave. East, Toronto 12, Ontario ..... HUdson 1-6461
In Other Countries—Petroleum Chemicals Division, Export Sales, 7496 Nemours Bldg., Wilmington 98, Del., OLympia 4-5121, Ext. 2962

DU PONT
REG. U. S. PAT. OFF.
Better Things for Better Living
. . . through Chemistry

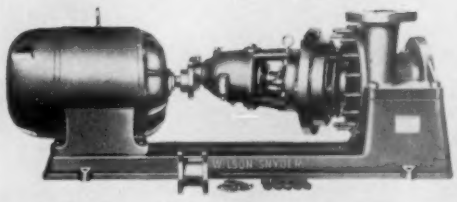
Petroleum Chemicals

E. I. DU PONT DE NEMOURS & CO. (INC.) · Petroleum Chemicals Division · Wilmington 98, Delaware

At the All New Yorktown, Va. Refinery of American Oil Company

82 Wilson-Snyder ES Centrifugal Process Pumps... like this

AMOCO®



Particularly designed for Processing Services at high temperatures to 900° F., high vapor pressures to 600 psi, and high discharge pressures to 750 psi.

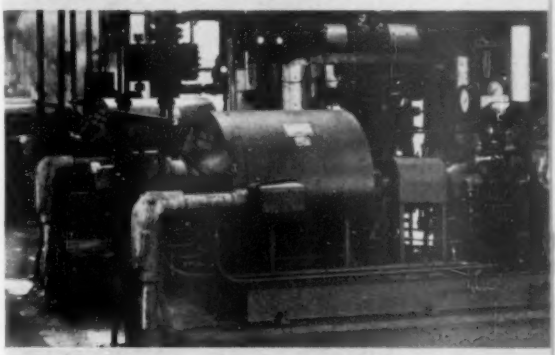
Available in 20 sizes from 15 to 2,000 GPM, 50 to 1,100 foot head, and 2 to 250 horsepower.

...perform a wide variety of processing services!

Very few pumping jobs are exactly alike. Each application involves various combinations of capacities, temperatures, differential heads and liquids with their individual characteristics and material requirements. Typical applications are illustrated here.

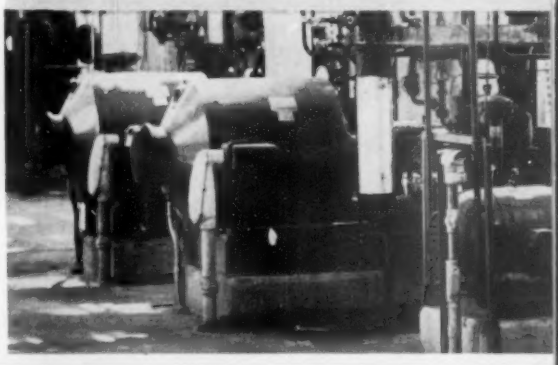
Yet . . . in addition to the broad capacity, temperature, and head range at high efficiency and the extra long service life that is inherent in Wilson-Snyder Centrifugal Process Pump design . . . a surprisingly small inventory of maintenance parts is required to service all sizes. Only THREE SIZES of bearing bracket assemblies, including shafts, sleeves, bearings and packing need be stocked to service all of the TWENTY pump sizes in the line.

This is why so many users are finding it extremely economical and practical to standardize on these pumps for all requirements within the scope of their application.



These Vacuum Tower Intermediate Reflux Pumps (size 6x8x10½" ES — Top Suction) handle Hot Oil of .672 specific gravity at 550° F. pumping temperature with 318 ft. differential head with capacity range from 1365 to 1570 GPM with 150 HP driving motors.

On the "Cat Cracker" Unit, these pumps (size 3x4x16" ES — Top Suction) handle Low Pressure Distillate of .739 specific gravity at 100° F. pumping temperature with 815 ft. differential head and capacity of 254 GPM with 150 HP driving motors.



Specify Wilson-Snyder process pumps for your requirements

OIL WELL SUPPLY
DIVISION UNITED STATES STEEL CORPORATION
Executive Offices—**DALLAS, TEXAS**

with Refinery Equipment Specialists at

Calgary, Canada	Houston, Texas	Los Angeles, Calif.
Dallas, Texas	New York, N. Y.	Odessa, Texas
Chicago, Illinois	Braddock, Pa.	Tulsa, Okla.
	Corpus Christi, Texas	

Branches Serving All Oil Fields

USS TRADE MARK

"OILWELL" TRADE MARK

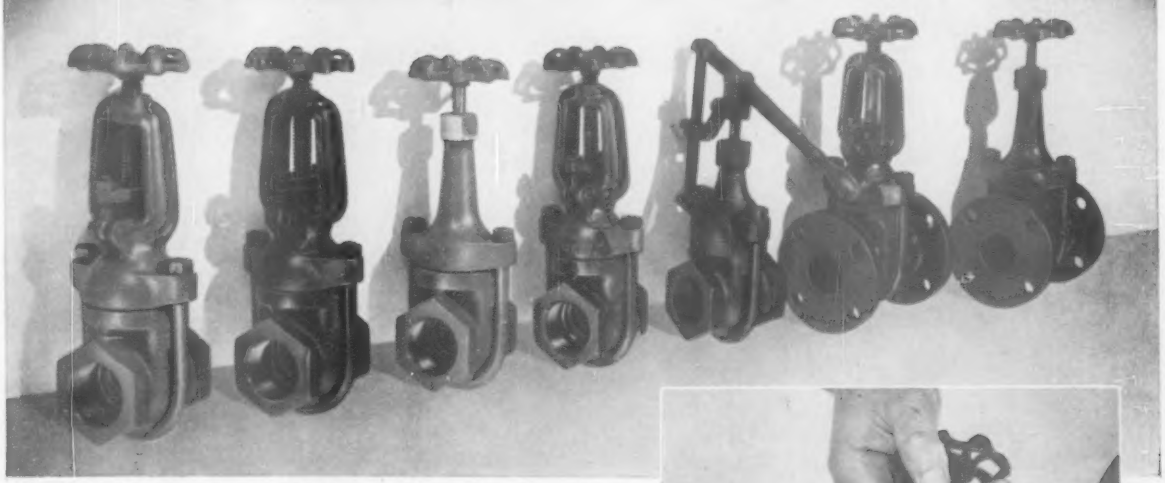
UNITED STATES STEEL

Eleven lines of WALWORTH Saddle Type Wedge Gate Valves

Bronze-Mounted — All-Iron — Ni-Resist

Outside Screw and Yoke — Non-Rising Stem — Quick Opening

Flanged Ends — Screwed Ends



Walworth saddle-type wedge gate valves are manufactured in eleven different combinations of designs and materials, seven of which are illustrated above.

Saddle type wedge gate valves are easy to take apart and are particularly suitable for lines requiring frequent cleaning. Walworth Saddle-Type Wedge Gate Valves are available in a variety of designs including OS & Y; Inside Screw Rising Stem, and Sliding Stem Quick Opening types—in Bronze-Mounted, All-Iron, and Ni-Resist. All types are designed to permit repacking under pressure in either the open or closed position.

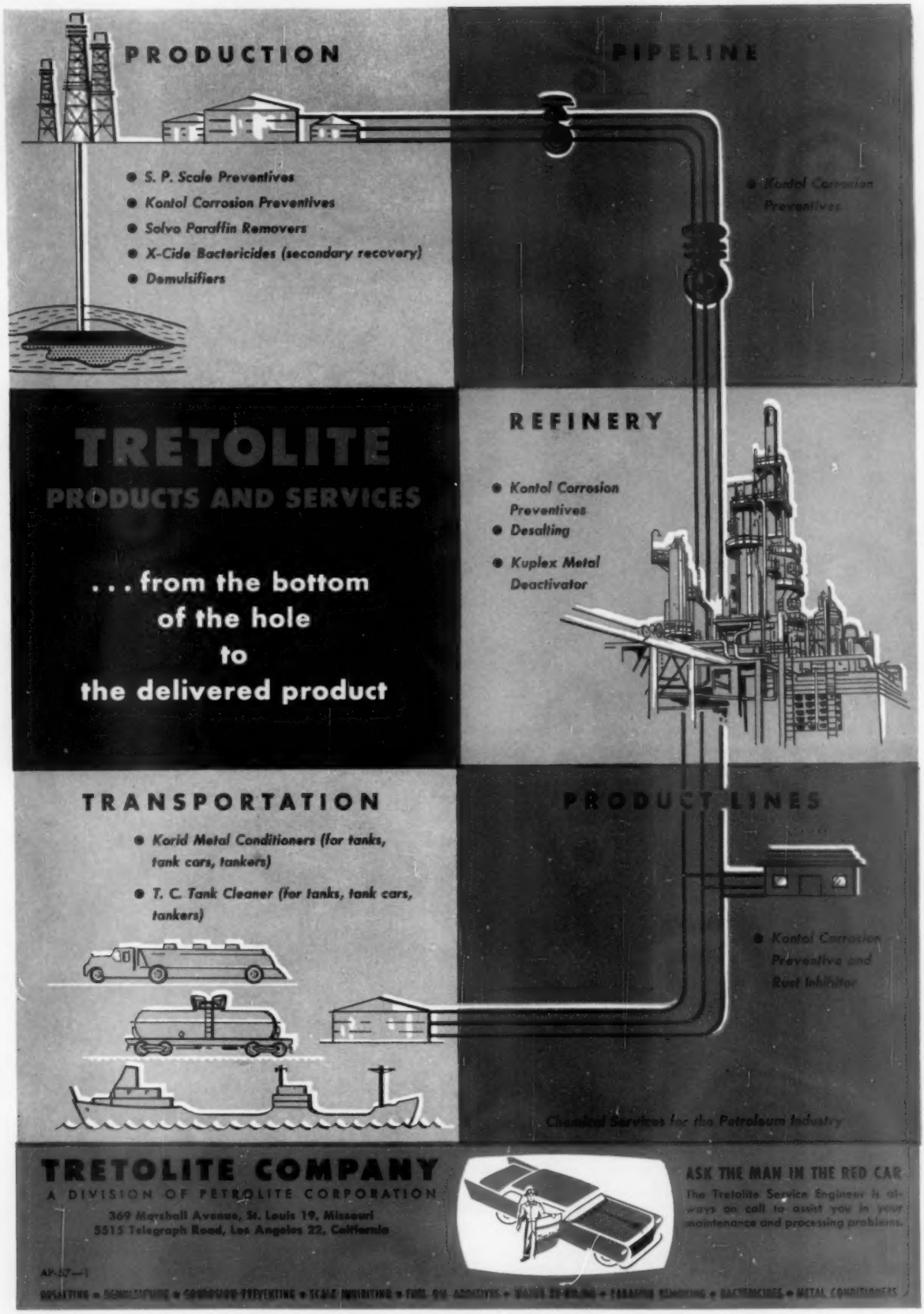
FOR COMPLETE INFORMATION, See your local Walworth Distributor or write on business stationery for illustrated circular.

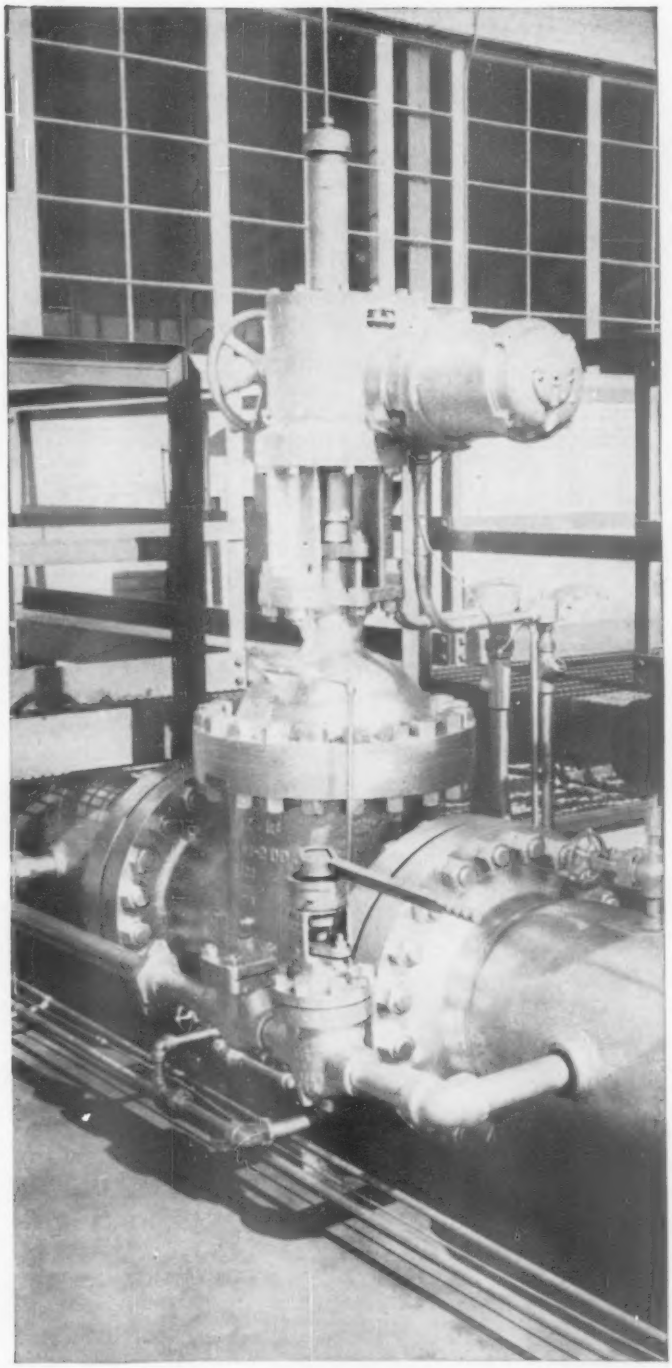
DISTRIBUTORS IN PRINCIPAL CENTERS THROUGHOUT THE WORLD

WALWORTH

60 East 42nd Street, New York 17, New York

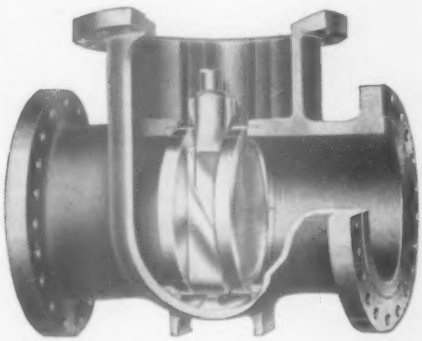
SUBSIDIARIES: ALOYCO ALLOY STEEL PRODUCTS CO. CONOFLOW CORPORATION GROVE VALVE & REGULATOR CO. SW SOUTHWEST FABRICATING & WELDING CO., INC. MH M & H VALVE & FITTINGS CO. WALWORTH COMPANY OF CANADA, LTD.


PRODUCTION
S. P. Scale Preventives
Kontol Corrosion Preventives
Solvo Paraffin Removers
X-Cide Bactericides (secondary recovery)
Demulsifiers
PIPELINE
Kontol Corrosion Preventives
TRETOLITE
PRODUCTS AND SERVICES
. . . from the bottom of the hole to the delivered product
REFINERY
Kontol Corrosion Preventives
Desalting
Kuplex Metal Deactivator
TRANSPORTATION
Karid Metal Conditioners (for tanks, tank cars, tankers)
T. C. Tank Cleaner (for tanks, tank cars, tankers)
PRODUCT LINES
Kontol Corrosion Preventive and Rust Inhibitor
Chemical Services for the Petroleum Industry
TRETOLITE COMPANY
A DIVISION OF PETROLITE CORPORATION
369 Marshall Avenue, St. Louis 19, Missouri
5515 Telegraph Road, Los Angeles 22, California
ASK THE MAN IN THE RED CAR
The Tretolite Service Engineer is always on call to assist you in your maintenance and processing problems.
AP-57—1



DARLING

fully-revolving double disc
pipe line gate valve



IDEAL FOR EFFICIENT CONTROL

Here's why

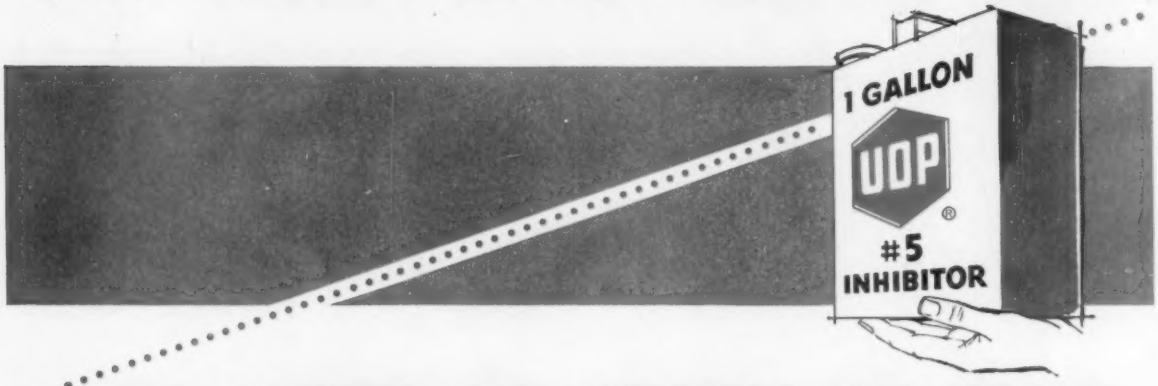
Operation is *consistently* trouble-free! Minimum friction, easy opening and closing, with self adjustment for positive closure. Wedging principle automatically compensates for any body deflection. Fully revolving discs avoid wear concentration. Discs and seats wipe clean with each operating cycle. In short . . . prolonged high efficiency with an extreme minimum of attention. It will pay you to give us an idea of your service needs and get specific details.

DARLING VALVE & MANUFACTURING CO.

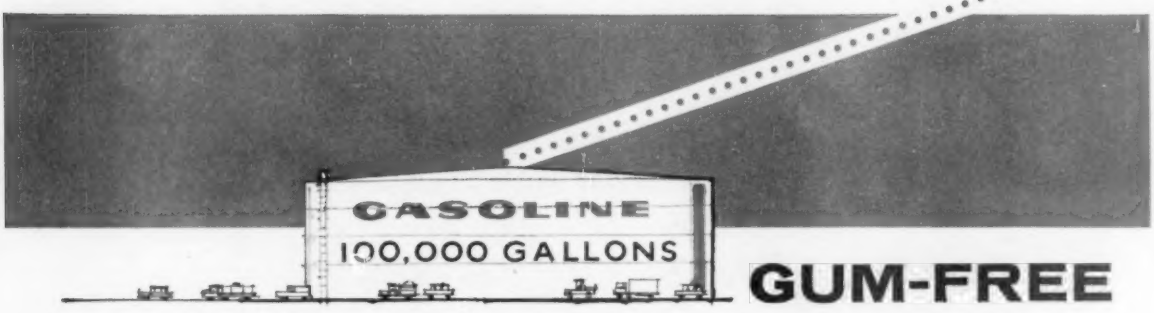
Williamsport 1, Penna.

Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ont.

* IT TAKES SO LITTLE OF THIS



* TO KEEP SO MUCH OF THIS



GUM-FREE

Even though UOP #5 Inhibitor is the most economical you can use (only 5 molecules of UOP #5 protect as many as 1,000,000 molecules of gasoline), it is also the only inhibitor that can handle the tough stability jobs.

The formation of gum in modern gasolines is the one universally recognized cause of engine manifold deposits. UOP Inhibitor #5 has been proven, by test and actual use, the best preventative for this. It's effective, too, in preventing the decomposition of TEL in stored gasolines.

UOP's technical staff has pioneered the development of techniques of finishing gasolines for maximum gum stability and engine cleanliness. Why not let us help you answer your stability problems more efficiently and at a lower cost?

UOP #5 is one of a number of UOP inhibitors and additives available to the refining industry. If you have a protection or preservation problem for product or transport facilities consult us.

PRODUCTS DEPARTMENT

UOP UNIVERSAL OIL PRODUCTS COMPANY

30 ALGONQUIN ROAD, DES PLAINES, ILLINOIS, U.S.A.

Buy the one tube steel with the longest tube life per dollar: *Ask the experts!*

THE Timken Company makes 23 different high-temperature tube steels to help you solve your heat, pressure, corrosion and oxidation problems. But only *one* analysis really fits your particular needs, gives you maximum tube life per dollar—your best life/cost ratio. To find this *one,* right analysis, *ask the experts!*

Timken Company metallurgists are recognized authorities on high-temperature steels. They have over 20 years of experience backing them up. They'll put this experience to work for you, study your specific requirements, recommend the *one* tube steel that fits them—most economically.

You can be sure, too, that the analysis of Timken® steel you get will have uniform high quality. Because the Timken Company makes its own fine alloy electric furnace steels, it can maintain rigid quality control from melt shop through final inspection.

Timken Company metallurgists will be glad to help you solve your tube steel problems. Ask the experts! The Timken Roller Bearing Company, Steel and Tube Division, Canton 6, Ohio. Cable address: "TIMROSCO".

This month's report is on:

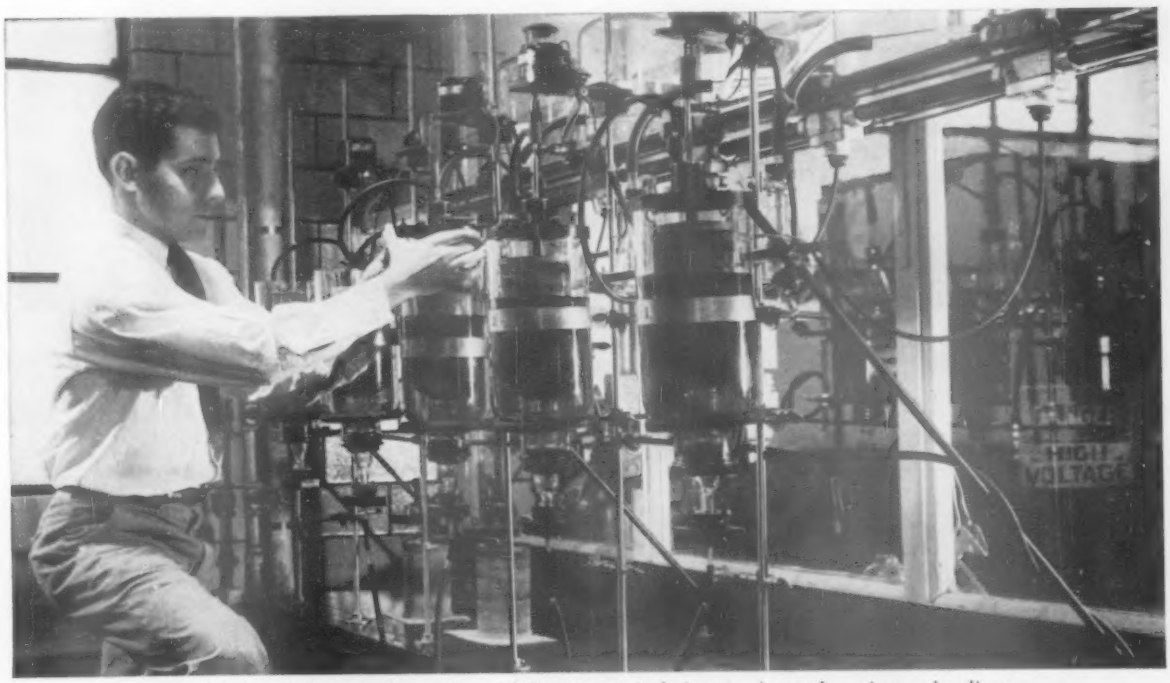
DM STEEL

Has unusually high creep strength for a pearlitic steel, good stability up to 1200°F., fairly good corrosion and oxidation resistance. Has 2 to 3 times the life of carbon steel where corrosion is not severe. Recommended for cracking furnace tubes, hot oil lines, superheater tubes, high temperature steam piping and forgings for accessory parts.

23 TIMKEN STEELS FOR HIGH TEMPERATURE SERVICE

Carbon	Sicromo 2	Sicromo 5S	16-13-3
Carbon-Mo.	Sicromo 2½	Sicromo 5MS	25-20
DM-2	2½% Cr.-1% Mo.	Sicromo 7	25-12
Silmo	Sicromo 3	Sicromo 9M	35-15*
DM	4-6% Cr.-Mo.	18-8 Stainless	16-25-6*
2% Cr.-Mo.	4-6% Cr.-Mo.-Ti.	18-8 Cb	

**Not available as seamless tubing at the present time.*



Special electrolytic extraction equipment helps separate inclusions, to give steel maximum cleanliness.

TIMKEN *Fine Alloy* **STEEL**

TRADE-MARK REG. U.S. PAT. OFF.

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS STEEL TUBING

®Traveloader... revolutionizes long load handling!

Here at last is a practical answer to the awkward problems of yard handling and particularly those nightmarish long loads. Traveloader combines the unique ability to pick up, carry and stack long, unwieldy or multiple pallet loads —indoors or out. Operating over paved or unpaved roadways, it does the job fast, safely, and much cheaper than other equipment.

This one machine, with one operator, replaces two and often three fork trucks, portable cranes or straddle carriers, and does the job better. You save manpower, cost of buying and maintaining other expensive equipment, aisle space, and time. Because Traveloader loads from the side and carries loads lengthwise, it requires much less aisle space than fork trucks.

Unlike a straddle carrier, this new machine can stack up to 12 feet high. And when traveling, the load is nested safely aboard the Traveloader's deck, eliminating dangerous dangling and swaying of load, distributing load evenly over four large wheels, and making speeds up to 30 MPH practical and safe.

Write for descriptive bulletin No. 1360.

ONLY TRAVELOADER

Picks up like a *straddle* truck • Delivers like a *highway* truck • Stacks like a *fork* truck

Baker®
industrial trucks

THE BAKER-RAULANG COMPANY
1247 WEST 80th STREET • CLEVELAND 2, OHIO
A Subsidiary of Otis Elevator Company

Otis
5T4

VALVES

to control anything but rain!

My Boss buys a lot of valves — or has it done — and he sure likes to buy them from J&L Supply.

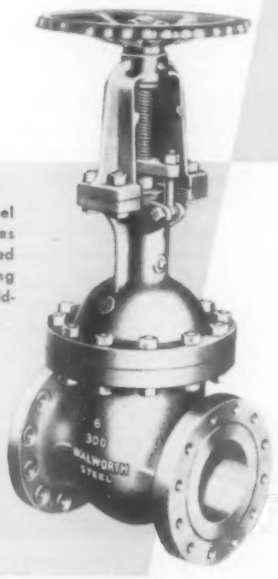
"Give those people the facts," says he, glancing at my new raincoat, "and they'll come up with the perfect valve for handling anything but rain."

"And what do we mean by the 'facts'?", says I, eager to be a good secretary.

"Oh," says he tolerantly, "to get the perfect valve for exacting jobs, we just give J&L complete service information: size and flange rating and facing, fluid to be handled, operating pressure, maximum temperature, any special corrosive conditions — that sort of thing."

"Oh?" says I.

"Young lady," says he, sensing my confusion, "don't expect to learn all about valves in a day. J&L Supply usually recommends Walworth, and Walworth was making and improving valves before your great granddaddy was born!"



Walworth Cast Steel Gate Valve, Series 300. Can be supplied with Roller Bearing Yoke and Butt Welding End.

29-G

Jones & Laughlin

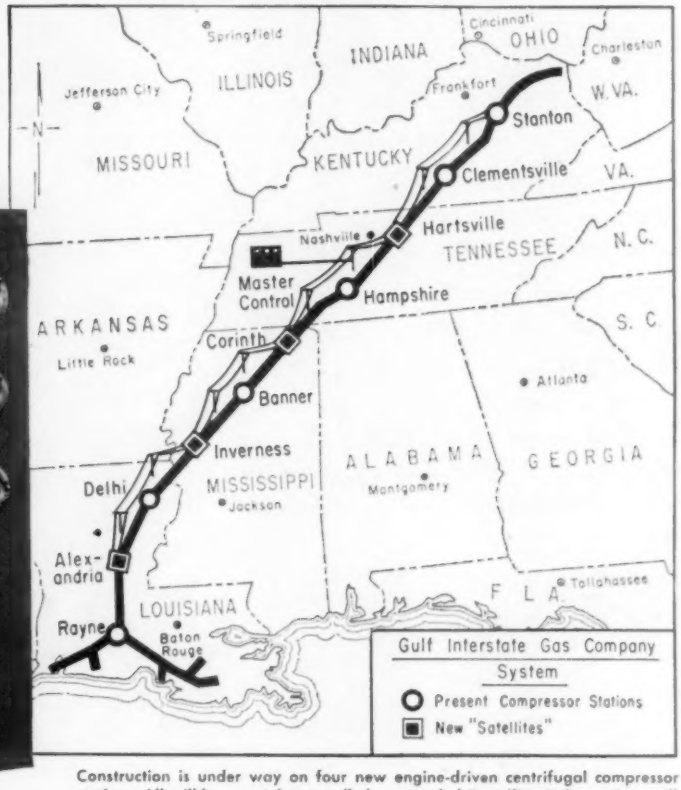
SUPPLY DIVISION – Tulsa

SERVING THE UNITED STATES AND CANADA

PIPELINE AUTOMATION PAYS!

Gulf Interstate's unattended "satellite" station shows how UNION C.T.C. lowers costs with safety and reliability.

UNION Control Panel at Stanton, Ky.



Construction is under way on four new engine-driven centrifugal compressor stations. All will be remotely controlled unattended "satellites." Operations will be directed from a UNION master control panel near the center of the system.

The Gulf Interstate Gas Company's "satellite" station at Stanton, Kentucky provides most economical and safe operation, according to Mr. R. Lo Chiano, assistant chief engineer at Gulf Interstate.

The Stanton station is remotely controlled from Clementsville, Ky., 90 miles away, through a UNION Centralized Transport Control System and has been on completely *unattended* operation since June 1956. This system is unique because it provides remote control and indications for a turbocharged engine driving a centrifugal gas compressor . . . the first installation of its kind. Large savings result because the operator at the master station can change the set point on the discharge pressure controller and start and stop the engine at Stanton.

Another important saving is obtained because the UNION C.T.C. System uses only one leased line circuit to transmit all the controls, indications and telemetering data. The control system used permits the use of the lowest-cost circuit. This installation was "custom engineered" using standard UNION components to meet the particular requirements.

The unattended station is definitely successful. There have been no false shut-downs that were not man made. With this in mind, future stations are being patterned after the one at Stanton.

Write for further information on UNION C.T.C. for all types of pipelines, gathering systems or tank farms. Ask for Bulletin 1052.

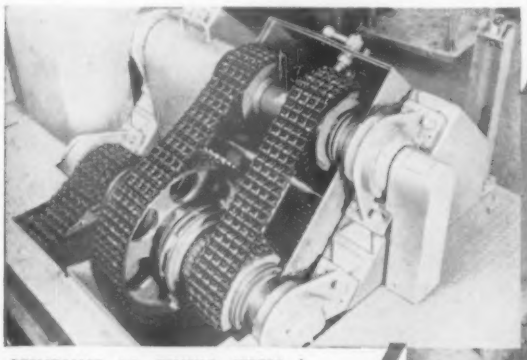
GENERAL APPARATUS SALES

UNION SWITCH & SIGNAL

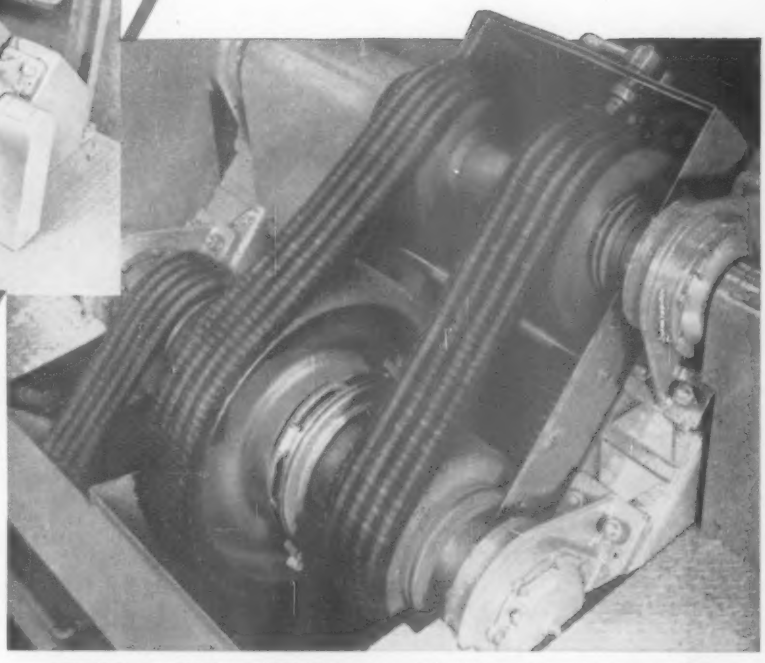
DIVISION OF WESTINGHOUSE AIR BRAKE COMPANY

PITTSBURGH 18, PENNSYLVANIA

It's not just static strength...



RESISTANCE TO TENSILE STRESS is achieved by use of properly heat-treated, accurately-machined sidebars made of premium steel and fitted with properly-hardened pins, bushings and rollers. But to resist *operational* stresses, additional controls over dimensional accuracy, uniformity and roller resiliency are essential.



STRENGTH OF CHAIN IN MOTION is accomplished through tensile strength *plus* special Link-Belt refinements. These include pitch-hole preparation, micro-finish of parts, special processing of sidebars, prelubrication and rigid quality control from initial selection of materials to final protective boxing. It means longer chain life on this two-speed pump drive of 5-section drive group on National Supply Company's No. 160 rig.

it's *dynamic strength*

in LINK-BELT Roller Chain that fights fatigue

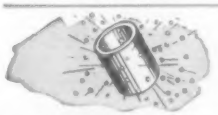
Serving on modern high-powered oil field equipment, the components of every pitch of roller chain face severe and repeated operating stresses—engagement with sprockets, shock of starting loads, centrifugal loads and others. That's why dynamic strength—ability of chain to resist these stresses—is so important. And it's built into every length of Link-Belt Precision Steel Roller Chain.

How is dynamic strength achieved? In addition to Link-Belt "extras" . . . special design, manufacturing and processing steps provide required properties of uniformity and accuracy for long-life operation.

Talk over your roller chain needs at your nearby Link-Belt office or any leading supply store in the field. Ask for Book 2680, covering this complete line of single and multiple widths up to 3-inch pitch. 14,224

LINK-BELT gives you dynamic strength that comes from these important EXTRAS.

PRE-STRESSING of multiple width chain provides uniform load distribution.



SHOT-PEENED ROLLERS have greater fatigue life, added ability to withstand impact.

SHEPHERD'S CROOK COTTERS will remain in place under severe operating conditions.

FASTER COUPLING and uncoupling of multiple width chain with E-Z Assembly feature.

LINK-BELT

ROLLER CHAINS & SPROCKETS

LINK-BELT COMPANY: Indianapolis 6, Houston 1, Dallas 21, Odessa, Tex., Shreveport, La., Los Angeles 33, Scarboro (Toronto 13); Export Office, New York 7. Distributors in All Fields.

No. 3 advertisement of six proving . . .

why Jones sucker rods last longer

1. *Advanced Research and Development*
2. *Advanced Engineering Experimentation and Control*
3. ✓ *Advanced Metallurgy and Heat Treating*
4. *Advanced Manufacturing and Production*
5. *Advanced Inspection and Testing Techniques*
6. *Advanced Field Engineering and Service*

There is a

The S. M. Jones Company ADVANCED METALLURGY AND HEAT TREATING . . . . .

The metallurgy and heat treating department functions all the way from the raw material to the finished product; as each heat of steel arrives at the plant, pilot bars are tested in the laboratory for required chemistry, and to determine the proper heat treating cycle to assure the best physical properties.

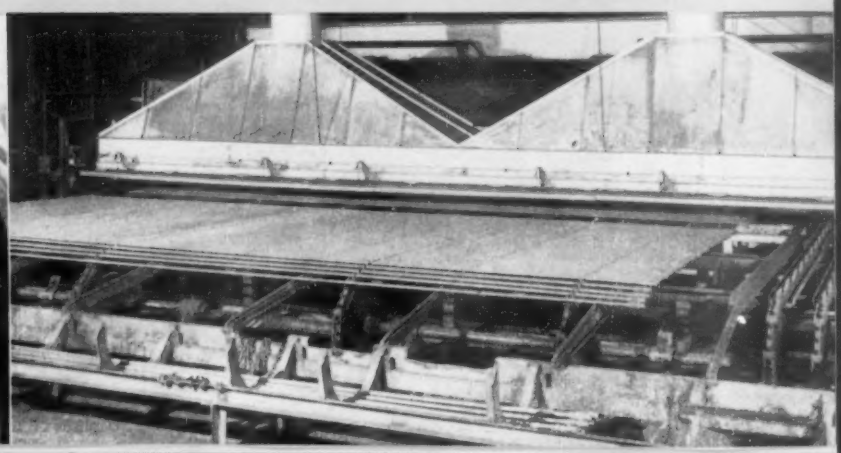
After passing inspection and testing, the processing begins with hot forging both ends of the stock. Careful control of the heating and gathering operations results in a forging of optimum strength because of proper grain flow and a minimum of decarb; then follows the heat treatment which refines the grain structure, developing the required physical properties.

Tougher, longer lasting sucker rods result from Jones carefully controlled metallurgy and heat treating.

PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION

Laboratory pre-testing of sucker rod stock develops optimum heat treating procedures for production control.

Production heat treating furnace with specially designed extra-long cooling bed insures maximum uniformity of grain structure as material is heated above and cools below critical temperatures.

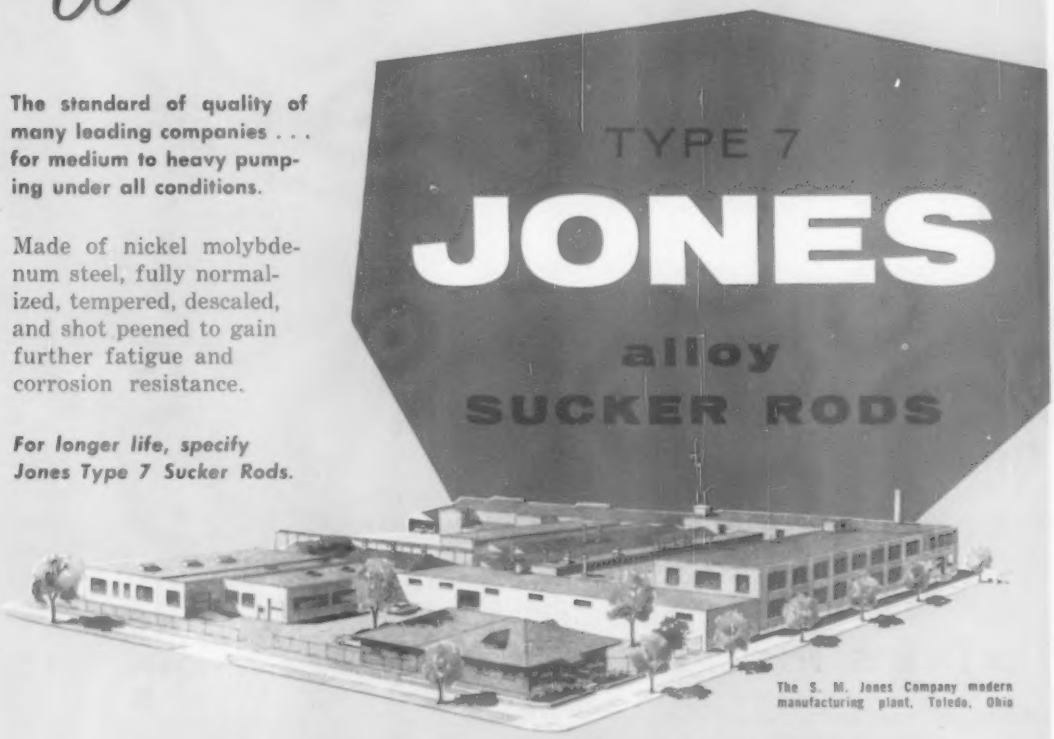


difference in sucker rods

The standard of quality of many leading companies . . . for medium to heavy pumping under all conditions.

Made of nickel molybdenum steel, fully normalized, tempered, descaled, and shot peened to gain further fatigue and corrosion resistance.

For longer life, specify Jones Type 7 Sucker Rods.



The S. M. Jones Company modern manufacturing plant, Toledo, Ohio

FOUR TYPES OF JONES SUCKER RODS FROM WHICH TO CHOOSE

Type	Identification	USE	DESCRIPTION	PHYSICAL PROPERTIES					
				Yield 1000 psi	Ultimate 1000 psi	% Elong. in 9"	% Red. of Area	Izod	Brinell Hardness
J-12	Protector ends painted BLUE	For heavy pumping loads under all conditions	Made from processed electric furnace steel with high yield strength and excellent fatigue resistance.	95-105	110-125	12-17	65-75	90-110	229-260
J-8	Protector ends painted BLACK	For extremely heavy pumping loads	A special alloy steel of exceptional yield strength and well-balanced physical properties.	100-115	120-135	10-15	50-60	65-85	240-260
J-7	Protector ends painted ORANGE	For medium to heavy pumping loads under all conditions	Called "standard of the industry". Strong, corrosion resistant nickle molybdenum steel, fully normalized, tempered, descaled and shot peened for further fatigue and corrosion resistance.	65-80	85-100	14-22	60-70	90-107	170-210
J-2	Protector ends painted WHITE	For medium to heavy pumping loads in non-corrosive fluids	High grade carbon manganese steel, fully normalized, descaled and shot peened to add strength and endurance.	60-75	90-105	18-24	60-70	69-90	169-210

Jones Pony Rods carry the same physicals as Jones Sucker Rods. Always use proved superior Jones Pony Rods with proved superior Jones Sucker Rods.

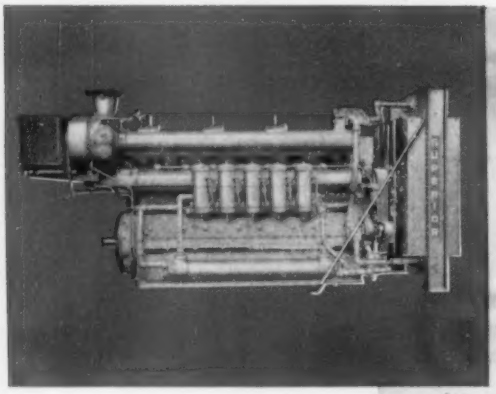
THE S. M. JONES COMPANY

●

Division of Buffalo-Eclipse Corporation

General Office and Factory:
TOLEDO, OHIO
Sales Office: Enterprise Building,
TULSA, OKLAHOMA
Export Sales Representatives:
IDECO—Division of Dresser Equipment Company, Republic National Bank Building, Dallas, Texas, and
Chanin Building, New York City

6673



powered by White's Superior Diesels . . .

SHORELINE'S RIG 7 DRILLS TO SUPER-DEPTHS

Tremendous depths, restricted only by present drill pipe and drilling methods, are reached by Shoreline Drilling Company's new Marine Rig 7, located in the West Delta Area off the Louisiana Coast. For prime power on this isolated Gulf platform, where drilling is being done for the CATC Group, Shoreline wisely chose three White PTDS-8 Supercharged Superior Diesels, each rated at 800 B.H.P.

Greater operating economy and dependability with White Diesels assure more profitable and continuous development drilling. Moreover, the up to 30% power increase in the newly improved Super PTD's gives greater working ability, more lugging power and faster acceleration. Yet engine size is not increased, resulting in less weight and less cost per horsepower.

Many other new design and engineering features make White Diesels outstanding for rugged, efficient, low-maintenance service. Superior Diesel, Dual Fuel or Gas oil field engines are available from 320 to 2150 B.H.P. Get the facts from leading rig manufacturers, White Diesel representatives in oil field areas, or the White Diesel Engine Division general office.

White Diesel

WHITE DIESEL ENGINE DIVISION
THE WHITE MOTOR COMPANY

Plant and General Offices: Springfield, Ohio

For faster machinery deliveries to the Middle East, Mediterranean and South America, ship American Airlines

AIRFREIGHT

American offers direct service from more oil manufacturing supply cities than any other airline

Now oil men who need machinery or parts in a hurry can schedule deliveries via American Airfreight. This way, they benefit from the extra speed of direct service from their suppliers. American covers more oil manufacturing supply cities than any other airline with service from HOUSTON, DALLAS, TULSA, OKLAHOMA CITY, LOS ANGELES, SAN FRANCISCO, PITTSBURGH, CHICAGO, DETROIT and ST. LOUIS. In addition, American serves drilling locations anywhere in the world on a through airbill.

AMERICAN AIRLINES AIRFREIGHT

—flies more freight than any other airline in the world

Profit More ~~Barrels~~ Per $ Spent

With CABOT

You can make more oil for every dollar invested when CABOT pumps are working for you!

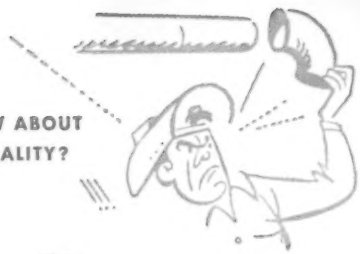
CABOT builds a pump that's specially designed for top production performance round-the-clock, month after month—unmatched when it comes to cost of operation—and, barrels of oil pumped.

Whether you specify the adjustable crank or beam-balanced series of CABOT pumps, you'll soon see the increased values of production, durability and serviceability.

See your J & L Supply Man.

OIL FIELD PUMPING EQUIPMENT
CABOT
PUMPS, INC.
PAMPA, TEXAS
FRANKS
DIVISION OF CABOT

HOW ABOUT AVAILABILITY?

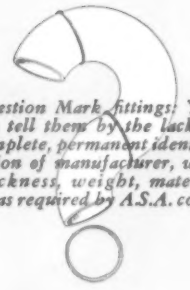


HOW ABOUT QUALITY?

HOW ABOUT IDENTIFICATION?

HOW ABOUT YOUR REPUTATION?

Why try to cut corners with *Question-Mark** fittings?



**Question Mark fittings: You can tell them by the lack of complete, permanent identification of manufacturer, wall thickness, weight, material ... as required by A.S.A. code.*

Unknown welding fittings are as risky as unmarked turns on a busy highway. These blind spots in an expensive piping project cause slow-downs, confusion, trouble . . . waste time and money.

"Question Mark" fittings may look like a bargain on the price tag, but watch out for the after-costs . . . poor fit-up, impaired quality, questionable supply, lack of engineering service! Your reputation is at stake!

A message in the interests of top quality piping . . .
by Tube Turns, Louisville, Kentucky.

HOW TO SAFEGUARD YOUR REPUTATION

He knows he's getting the exact fitting specified on the blueprint because each TUBE-TURN product is clearly marked with all designations.

Save manhours...avoid piping risks with known fittings

You save purchasing time, get prompt delivery, speed up installation, and help assure reliable piping performance when you specify TUBE-TURN* Welding Fittings and Flanges. They meet all American Standard and Safety Code requirements. Each product is permanently marked with complete size and material designation. Your nearby Tube Turns' distributor gives you prompt delivery from the complete-line stock, and makes available Tube Turns' unmatched engineering service.

You *know* your piping investment is safeguarded when you specify and buy Tube Turns' products.

Your nearby Tube Turns' Distributor meets your needs promptly from the complete line of more than 12,000 Tube Turns' stocked items.

The Leading Manufacturer of Welding Fittings and Flanges

TUBE TURNS LOUISVILLE 1, KENTUCKY

A Division of National Cylinder Gas Company

DISTRICT OFFICES: New York • Philadelphia • Pittsburgh • Chicago • Detroit • Atlanta • New Orleans • Houston • Midland
Dallas • Tulsa • Kansas City • Denver • Los Angeles • San Francisco • Seattle
In Canada: Tube Turns of Canada, Ltd., Ridgetown, Ontario • Toronto, Ontario • Edmonton, Alberta

*"TUBE-TURN" and "tt" Reg. U. S. Pat. Off.

TRECO — CONTRACTOR TO AMERICA'S FAMOUS REFINERS*

The REFINERY ENGINEERING Company is proud to have served the majority of America's best-known refiners in the field of Engineering, Design and Construction. Each year sees our list of satisfied clients expanding.

Back of this steady expansion is the satisfactory completion of each contract on, or ahead of time; the ease and economy of operation of the plant as well as the small amount of "down time."

Treco has purchased a tract of land, in excess of three acres. This new facility provides more than 14,000 square feet of air-conditioned offices with paved parking for over 200 cars. There is also a cafeteria building and two other buildings of 9,700 feet and 37,000 feet of space for expanding Treco activities.

* The Trade Marks above are of the companies Treco has recently served.

The REFINERY ENGINEERING Company has just produced a brochure which shows the Company's facilities with photographs of completed projects. A copy will be mailed you promptly upon request on your company's letterhead.

ESSO STANDARD OIL COMPANY

McCOLL-FRONTENAC OIL COMPANY, LTD.

PHILLIPS PETROLEUM COMPANY

CONTINENTAL OIL COMPANY

SHELL OIL COMPANY

THE TEXAS COMPANY

SINCLAIR REFINING COMPANY

COSDEN PETROLEUM CORPORATION

D-X SUNRAY OIL COMPANY

ROYALITE OIL COMPANY, LTD.

KERMAC

KERR-McGEE OIL INDUSTRIES, INC.

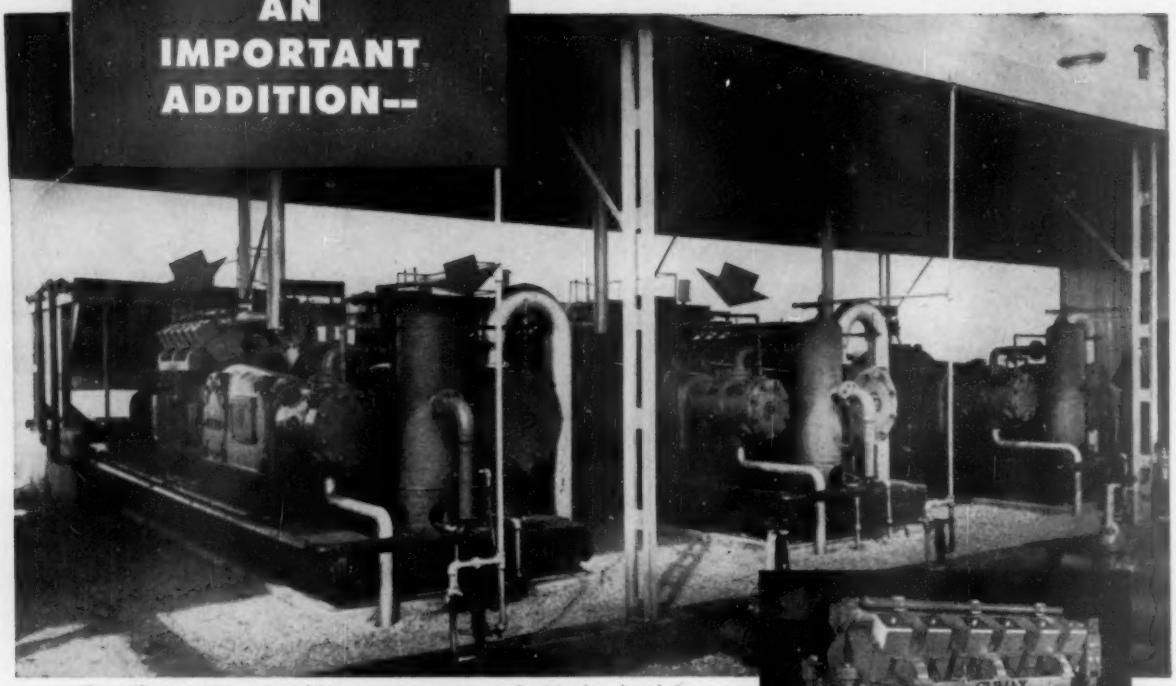
TRECO

DIVISION of VITRO CORPORATION of AMERICA

The REFINERY ENGINEERING Company

NEW YORK TULSA TORONTO

AN IMPORTANT ADDITION--



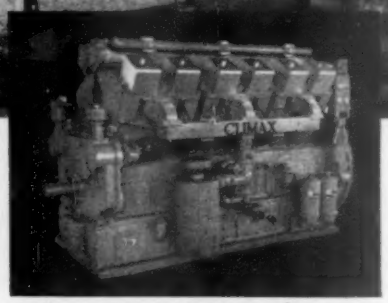
Three Climax V-122 engines driving gas compressors at the Woodward and Co. Gasoline Plant near East Washington, Okla.

TO A *GROWING LIST* OF CLIMAX ENGINE INSTALLATIONS

Climax heavy duty gas engines were selected to drive the compressors in Woodward and Company's new gasoline plant near East Washington, Oklahoma. This plant, having a design capacity of 3.5 million cubic feet per day, was engineered and constructed by Tinkham Engineering & Construction Company of Dallas, Texas, and includes three Model V-122 Climax engines driving Oil Well Supply DGE-250 gas compressors.

Rugged construction, modern design and a reputation for long service with maximum economy and minimum down time are features which make Climax engines outstanding wherever dependable power is required.

Climax engines are specially designed for compressor drive and are available in sizes from 100 to 350 H.P. for 24-hour round-the-clock service.



A Climax V-122, 12 cylinder, 7 x 7" engine with a 3232 cubic inch displacement.

OUTSTANDING FEATURES OF CLIMAX V & K SERIES ENGINES

- All models have renewable cylinder sleeves.
- All intake and exhaust valves are free-to-rotate type.
- All crankshafts are supported by bearings on each side of each crankthrow.
- All connecting rods are rifle drilled for pressure lubrication of piston pins.
- All cylinder heads have Climax high-turbulence type combustion chambers which produce maximum fuel economy.
- All models have the Climax consistent design that makes possible maximum interchangeability of wearing parts.

Write today for your copy of bulletin SA-611, "Special Power Units for Gas Compressors."

WHERE POWER IS YOUR PROBLEM — CLIMAX IS YOUR ANSWER

climax BLUE STREAK ENGINES

DISTRIBUTORS
Sales and Service

DRILLERS MACHINE SHOP
Oklahoma City, Okla. and Borger, Texas

GENERAL DIESEL & EQUIP. CO.
Williston and Fargo, N. Dakota

WILSON'S ENGINE & EQUIP. CO.
Bakersfield and Long Beach, Calif.

CULLANDER MACHINERY CO., INC.
Belzoni, Miss. and W. Memphis, Ark.

TOBIN MACHINERY CO.
Lafayette, La.

VERN WALTON CO.
Coolidge, Casa Grande and Marana, Arizona

LANDES, ZACHARY & PETERSON
Denver, Colo. and 5 branches

UNITED POWER, INC.
Shreveport and Alexandria, La.

HOUSTON ENGINE & PUMP CO.
Houston and Corpus Christi, Texas

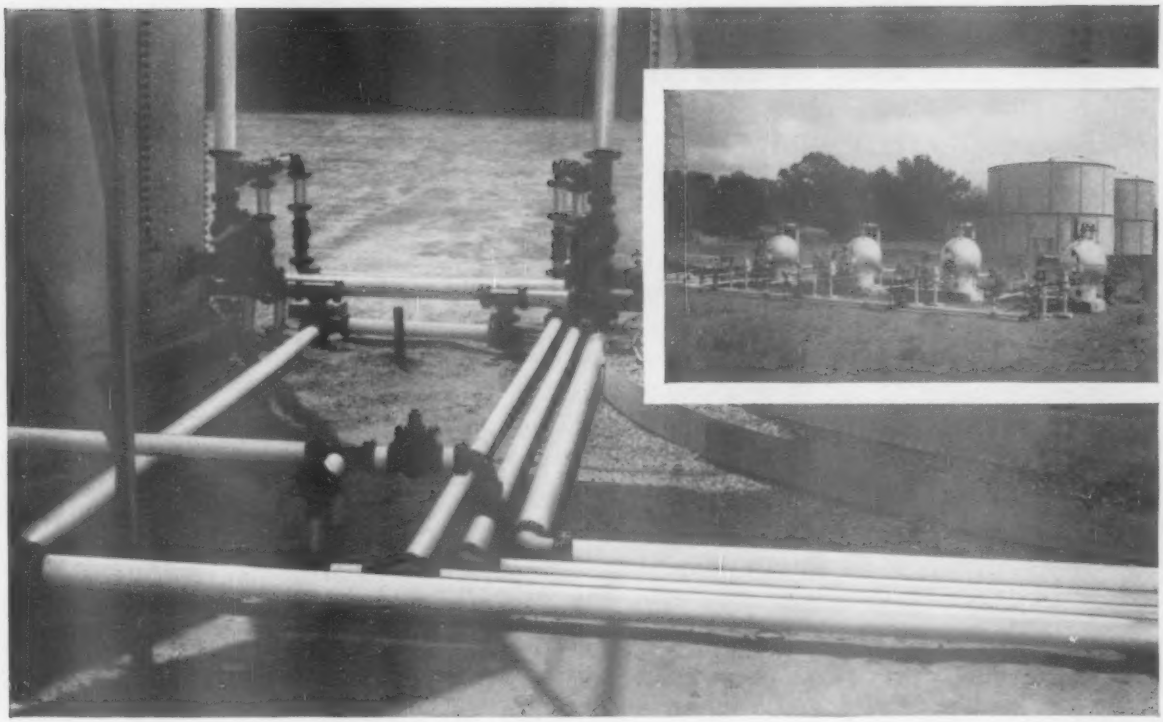
MIKE CARTER ENGINE WORKS
Wichita Falls, Texas

CARTER ENGINE SERVICE, INC.
Odessa, Texas

CARTER ENGINE & EQUIP. CO.
Abilene, Texas

INDUSTRIAL POWER & SUPPLY CO.
Longview, Texas

CLIMAX ENGINE AND PUMP MFG. CO.
208 SO. LA SALLE ST. CHICAGO 4, ILL.
FACTORY • CLINTON, IOWA
DISTRICT OFFICE • 155 CONTINENTAL AVE., DALLAS 7, TEXAS



Aluminum Pipe Saves $284 on 600 bbl. Tank Battery Hookup

If you have a two-tank, 600 barrel storage battery, you can save from 25% to 30% on hookup costs as one Victaulic Coupling user did. How? By using Reynolds Aluminum Oil Country Pipe instead of T & C black line schedule 5 pipe.

Not only was Reynolds Aluminum Oil Country Pipe less expensive than the equivalent black line pipe, but it was easier to cut, groove, couple and handle; it will never need painting. Labor costs to install the hookup were cut about 40%. And these savings hold for a wide range of piping jobs in the drilling, production, processing and transportation fields.

Lightweight Reynolds Oil Country Pipe cuts installation time and labor wherever it goes. One man can carry a 30 foot section easily; one truck can carry *three miles* of pipe! You can figure about 10 man-hours per mile for laying an aluminum line—compared with 50 or 60 man-hours for steel. And Reynolds Aluminum Oil Country Pipe is easy to hook up; it's flexible, so it can be contoured over rough ground, can make shorter turns.

Aluminum's resistance to rust and corrosion makes it even more practical in seawater, or in handling corrosive chemicals, crude oils and refined gases.

You'll find Reynolds Oil Country Pipe easy to get, too. It's stocked by leading suppliers throughout the oil country, and standard aluminum fittings are available from top manufacturers.

Get all the facts on how much you can save—in first cost, installation costs, and over-the-years maintenance and operating costs—with Reynolds Aluminum Oil Country Pipe. Phone your local Reynolds office (listed under "Aluminum") today.

Write for free brochure:

Reynolds Aluminum Pipe for Tank and Battery Hookup, Reynolds Metals Company, P. O. Box 1800-CR, Louisville 1, Kentucky

See "CIRCUS BOY", Reynolds exciting dramatic series, Sundays on NBC-TV.

The Finest Products Made with Aluminum are made with REYNOLDS ALUMINUM

For catalytic reforming...

Forty refineries specified Clark

User	*Location*	*No. of Units*
Atlantic Refining Company, The	Point Breeze, Pennsylvania	2
BP Refinery (Kent) Ltd.	Kent, England	1
Burmah-Shell Refineries Ltd.	Bombay, India	1
Bahrain Petroleum Company, Ltd., The	Bahrain, Persian Gulf	1
Caltex Petroleum Maatschappij N.V.	Pernis, Holland	1
Compagnie Francaise de Raffinage	La Mede, France	1
Gulf Oil Corporation	Girard Pt., Pennsylvania	4
Gulf Oil Corporation	W. Pt. Arthur, Texas	4
*	Eastern Canada	1
McColl-Frontenac Oil Company Limited	Montreal, Canada	1
Ohio Oil Co., The	Robinson, Illinois	1
Phillips Petroleum Company	Phillips, Texas	1
Phillips Petroleum Company	Kansas City, Kansas	1
Pure Oil Company, The	Smith Bluff, Texas	1
Refineria de Petroleos de Escombreras, S.A.	Cartagena, Spain	2
Shell Oil Company	Wood River, Illinois	2
Shell Oil Company	Deer Park, Texas	1
Shell Oil Company	Houston, Texas	2
Shell Oil Company	Anacortes, Washington	1
Shell Oil Company of Canada Limited	Montreal, Canada	1
Shell (Refining) Australia Pty. Ltd.	Geelong, Australia	1
Sinclair Refining Company	Marcus Hook, Pennsylvania	2
Sinclair Refining Company	E. Chicago, Illinois	2
Societe Francaise des Petroles BP	Dunkirk, France	1
Societe Industrielle Belge des Petroles	Antwerp, Belgium	1
Socony Mobil Oil Company, Inc.	Paulsboro, New Jersey	1
Societe per l'Industria Italiana del Petrolio	La Spezia, Italy	1
Standard Oil Co. of California	El Segundo, California	2
Standard Oil Co. of California	Richmond, California	2
*	Central Kansas	1
Standard Oil Co. of Ohio	Toledo, Ohio	2
Sun Oil Company	Toledo, Ohio	1
D-X Sunray Oil Company	Tulsa, Oklahoma	1
Suntide Refining Company	Corpus Christie, Texas	2
Texas Company, The	Wilmington, California	1
Texas Company, The	Laurenceville, Illinois	2
Texas Company, The	Westville, New Jersey	2
Texas Company, The	Pt. Arthur, Texas	5
Tidewater Oil Company	Delaware City, Delaware	1
Wilshire Oil Co. of California	Norwalk, California	2

*Name furnished on request

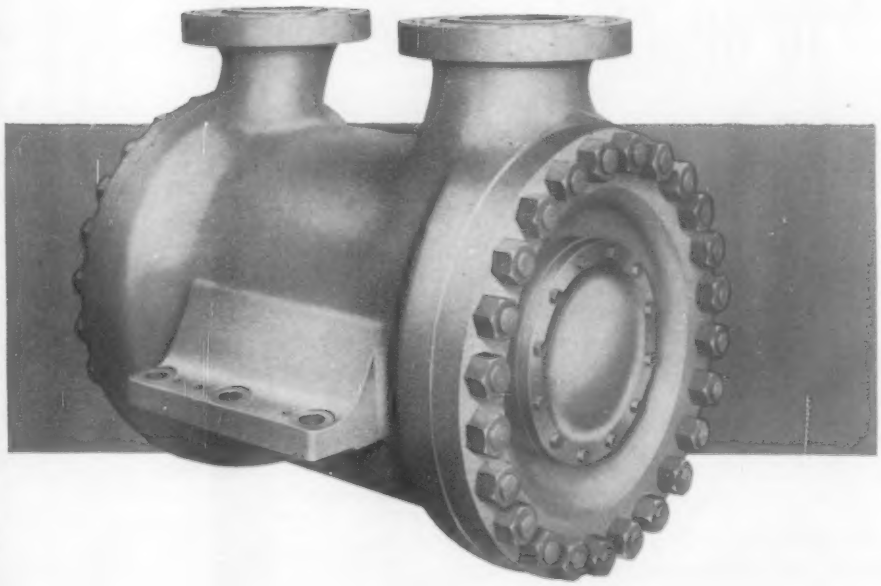
60% choose Clark

Vertically-split centrifugal compressors

Forty major refineries are using or have ordered Clark vertically-split centrifugal compressors for their reforming needs. That's over 60% of the total requiring centrifugal compressors.

We could mention many reasons why these Clark units outsell all other makes combined, but we prefer to let the facts speak for us. Remember 6 out of 10 are Clark . . . how about your next reformer?

CLARK BROS. CO., OLEAN, N. Y.
One of the Dresser Industries
Offices in Principal Cities throughout the World



CLARK®

Centrifugal Compressors

CATFORMING

YOUR LOW-COST KEY TO HIGH OCTANES

CATALYSTS — Specific type for your problems.

SELECTIVITY — Superior yield at high octanes.

STABILITY — High activity with long life.

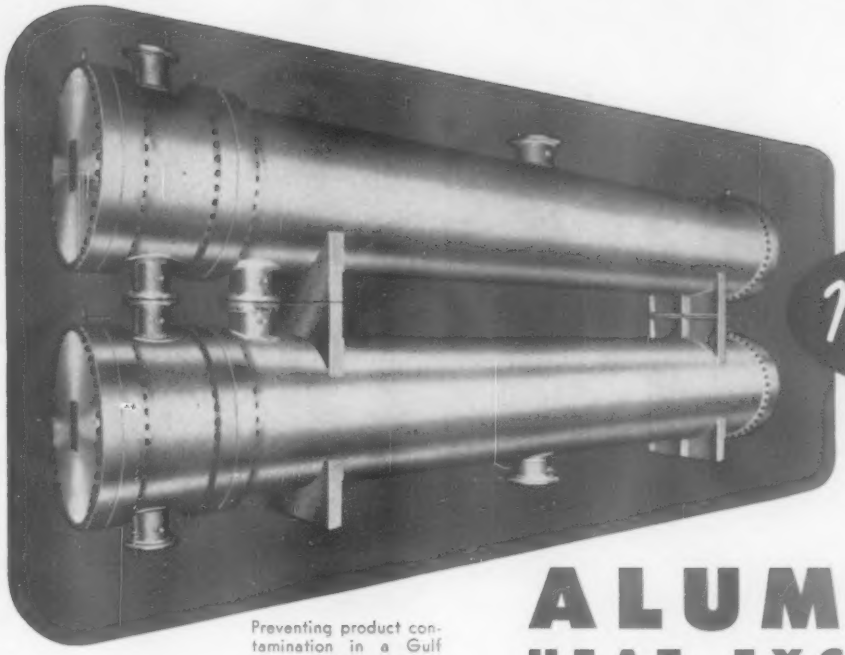
DURABILITY — Tolerance for moisture and nitrogen.

REGENERATION — To extend normal life or recover from upsets.

For further information on Catforming, write or wire The Atlantic Refining Company, P. O. Box 8138, Philadelphia 1, Pennsylvania.

it's the **CATALYST** that counts

ATLANTIC

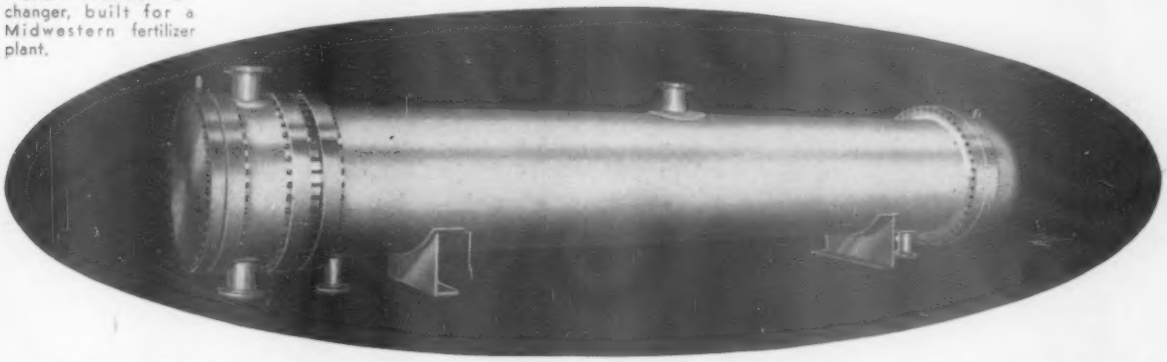


SPECIAL *Metallurgy*

ALUMINUM HEAT EXCHANGERS from WESTERN

Preventing product contamination in a Gulf Coast high density polyethylene plant is the application for which these Western Aluminum Exchangers were designed.

Corrosion resistance to ammonium nitrate solutions is the job of this Western Aluminum Exchanger, built for a Midwestern fertilizer plant.



Exemplary of Western's experience in special alloy fabricating are these all-aluminum exchangers—wherein Western's metal inert gas and tungsten inert gas welding equipment, along with other specialized equipment and facilities—are utilized to produce heat exchangers specifically designed for handling specific corrosive fluids. Western's background in special metals has been successfully applied to Austenitic Stainless Steels —High Chrome Irons—Low Chrome Moly Steels— Monel—Copper Silicon—Nickel—and Aluminum.

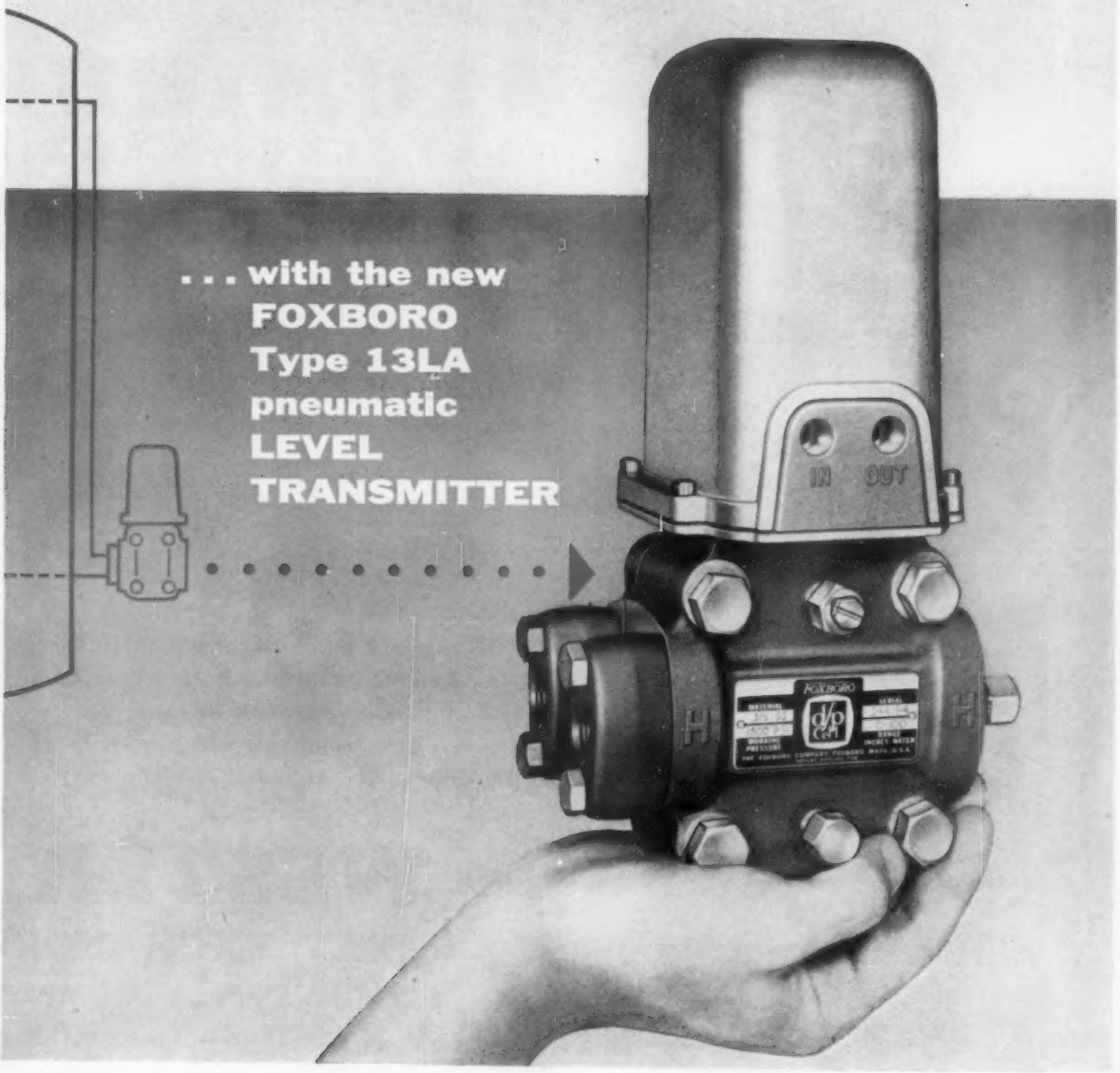
You can profit from Western's extensive metallurgical experience. All we need is the opportunity.

WESTERN
HEAT EXCHANGERS
WESTERN SUPPLY COMPANY
P. O. Box 1888 – Tulsa, Oklahoma

NEW SIMPLICITY

FOR LIQUID LEVEL

. . . with the new
FOXBORO
Type 13LA
pneumatic
LEVEL
TRANSMITTER



MEASUREMENT !

Easy Low-Cost Installation on any closed or open tank. Only two small pressure taps required. Nothing inside tank!

Fully-Adjustable Ranges . . . 0-20" to 0-80" and 0-50" to 0-250" H_2O.

Complete adjustment for elimination of outside leg effect gives forward-reading signal to any standard receiver!

Highest Sustained Accuracy . . . Instant, precise response to level changes even under extreme operating conditions.

Rugged and Corrosion-Resistant . . . Level-sensing element is Type 316 stainless steel, silicone-filled "capsule" diaphragm applicable on static pressures up to 1500 lbs.

There's nothing simpler for accurately measuring liquid level than the Foxboro Type 13LA d/p Cell* Liquid Level Transmitter! No floats, knife edges, stuffing boxes, or complicated hook-ups. A simple, direct piping job connects it to the tank . . . operates in any position, even upside down. The Transmitter precisely measures difference in head caused by level change . . . sends 3-15 psi air signal over single air line to indicator, recorder, or controller. It's easily traced when required, up to 250°F., to maintain fluidity of liquid.

The 13LA d/p Cell Transmitter is low in initial cost, requires practically no maintenance. In addition, it is easily converted in field for the measurement of fluid flow. It's the ideal instrument for heavy industrial applications . . . indoors or out. For complete details, ask your nearest Foxboro Sales Engineer, or write for new Bulletin 13-22 to **The Foxboro Company, 603 Norfolk St., Foxboro, Mass., U.S.A.**

*Reg. U. S. Pat. Off.

FACTORIES IN THE UNITED STATES, CANADA, AND ENGLAND

FOXBORO
REG. U. S. PAT. OFF.

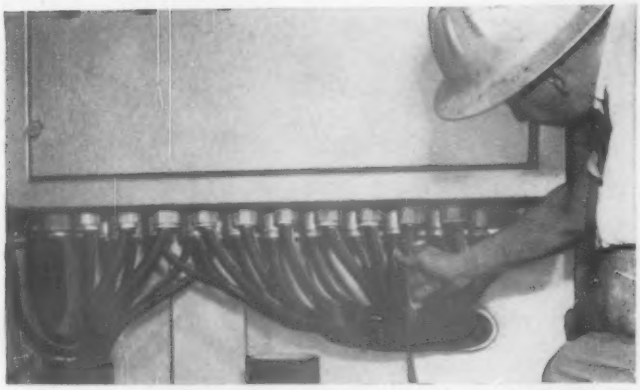
LIQUID LEVEL TRANSMITTER

You can't run a refinery on materials "in transit"

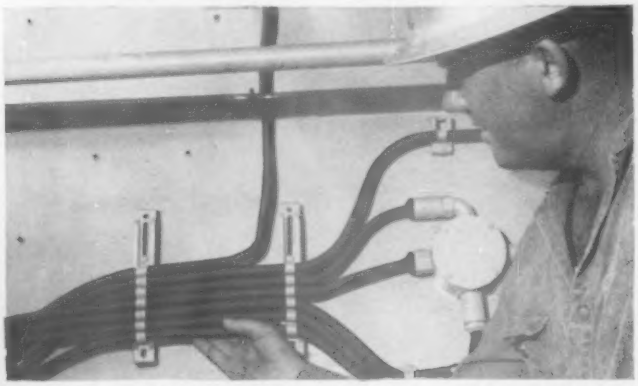
That's why our Traffic men stay right on top of every shipment till it gets into your hands. That's why Frontier has its own big fleet of tank cars and fast highway truck and trailer rigs. Keeping our friends in the oil and gas industry dependably supplied with caustic soda and muriatic acid is an obligation we take seriously at Frontier. We believe you'll like Frontier service. Give it a trial — and see for yourself.

Frontier Chemical Company

Wichita, Kans. • Denver City, Tex. Midland, Tex. • Denver, Colo. • Dumas, Tex.



• Exposure to flexing, oil, grease or sunlight won't cause deterioration of neoprene jacketing on this cable. Resistance to flame and aging are two other advantages of neoprene that mean extra safety, extra long service.



• No conduit needed for rugged neoprene-jacketed cable. It resists weathering, ozone, electrolytic attack . . . stays flexible. Cable can be easily repositioned without cracking neoprene jacketing.

ON PHILLIPS PETROLEUM BARGE Nº 41

Neoprene-jacketed cable replaces steel-armored for electrical system

The Phillips Petroleum Company's Drilling Barge No. 41 off Cheraton Beach near New Iberia, La., is equipped with neoprene-jacketed cable. This rugged cable was more economical on a footage basis than steel-armored cable, and offered definite service advantages for the barge's entire electrical system.

Normally the electrical system on a drilling barge is armored with steel to help prevent damage during installation. But engineers found the steel armor served no useful purpose after installation—it was usually allowed to rust away.

McIntosh Electric Co., contractors for No. 41, decided to try cable jacketed with neoprene, Du Pont's synthetic rubber, and their decision was justified. Rugged neoprene jacketing did not crack under severe flexing and abrasion . . . withstood exposure to oil, grease and heat. And flexible neoprene-jacketed cable proved easier to install, easier to splice and naturally eliminated any chance of rust.

Drillers count on neoprene's lasting resistance to weather, sunlight and aging as additional insurance against maintenance and replacement costs. Service records on neoprene parts in oil fields the world over support their conviction. Be sure the cable, drill-pipe protector or rotary hose you buy is made to last . . . be sure that it's made with DU PONT NEOPRENE.

FREE! THE ELASTOMERS NOTEBOOK. Every issue tells interesting stories about neoprene. Actual case histories show how neoprene products cut maintenance and replacement costs . . . improve performance. To get on mailing list, just write E. I. du Pont de Nemours & Co. (Inc.), Elastomer Chemicals Department OG-4, Wilmington 98, Delaware.

NEOPRENE

The rubber made by Du Pont since 1932

DU PONT

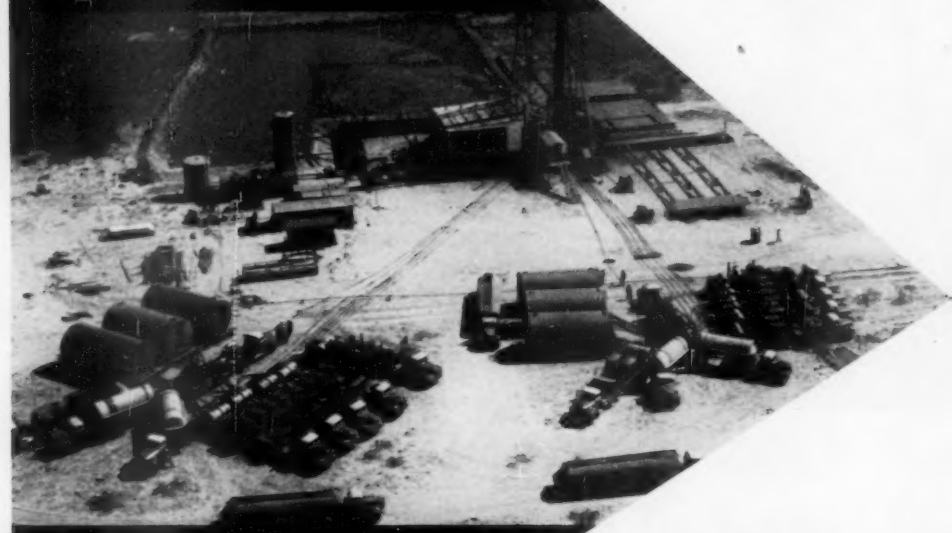
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

aids

to production stimulation

BY HALLIBURTON



Getting your well off to a healthy start demands a planned completion program.

Existing flow channels must be unobstructed. Where needed, new channels created. Proper selection of treating fluids and chemicals carefully placed help stimulate maximum recovery.

Let Halliburton's experienced personnel help you select the fracturing techniques and chemical materials best suited for the most effective production program of your particular well.

HALLIBURTON

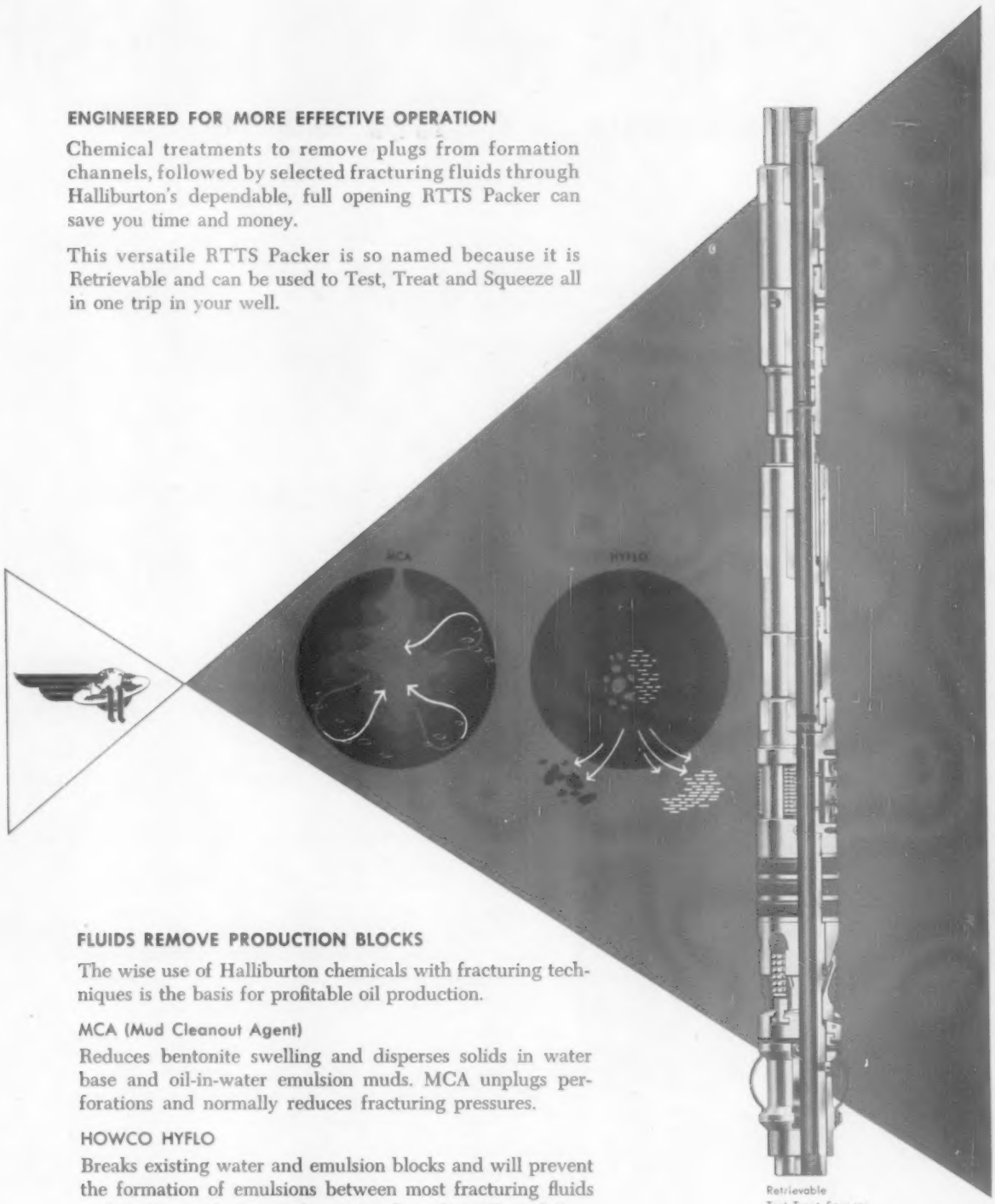
OIL WELL CEMENTING COMPANY

DUNCAN, OKLAHOMA

ENGINEERED FOR MORE EFFECTIVE OPERATION

Chemical treatments to remove plugs from formation channels, followed by selected fracturing fluids through Halliburton's dependable, full opening RTTS Packer can save you time and money.

This versatile RTTS Packer is so named because it is Retrievable and can be used to Test, Treat and Squeeze all in one trip in your well.



Retrievable
Test-Treat-Squeeze
Packer (RTTS)

FLUIDS REMOVE PRODUCTION BLOCKS

The wise use of Halliburton chemicals with fracturing techniques is the basis for profitable oil production.

MCA (Mud Cleanout Agent)

Reduces bentonite swelling and disperses solids in water base and oil-in-water emulsion muds. MCA unplugs perforations and normally reduces fracturing pressures.

HOWCO HYFLO

Breaks existing water and emulsion blocks and will prevent the formation of emulsions between most fracturing fluids and water. Hyflo leaves formation flow channels and fractures free and clean for maximum oil production.

HALLIBURTON

PIONEERS IN FRACTURING SERVICES

251 SERVICE CENTERS—JUST MINUTES AWAY FROM ANY RIG

FOR OIL INDUSTRY ENGINES • • • •

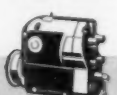
Better to Start with—
Best in the Long Run!

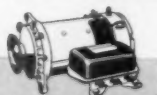
AMERICAN BOSCH
MAGNETOS

Steadily improved electrical and mechanical characteristics give these famous Magnetos greater power, PLUS the traditional built-in stamina that assures *years* of constant, trouble-free ignition in Drilling, Pumping, and Pipe line engines. This is why these power-packed Magnetos are so steadily used as original equipment by so many leading engine builders.

On all your present equipment, with either high or low tension ignition systems, you can have this instantaneous spark efficiency and matchless dependability at all engine operating speeds and loads. For, there's an American Bosch Magneto replacement precisely engineered for the largest, heavy-duty engine, right down to the most modern, high-speed power unit. Moreover, American Bosch can serve you well through one of the largest and most efficient field service organizations. There's an AB Service Agency near you. Write to us today for Magneto replacement application data on your high or low tension engines. American Bosch, Springfield 7, Mass. A Division of American Bosch Arma Corporation.

AMERICAN BOSCH

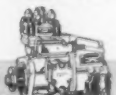

Automotive and Aviation Magnetos


Generators and Regulators

Components for Aircraft Engines

Small Electric Motors

Electric Windshield Wipers


Diesel Fuel Injection Equipment

It costs so little more to "go first class"

. . . and
UNIBOLT
flow manifolds
give you <u>so much more</u>
for your money

Pressure-tested as a unit and available in a full range of pressures:

3000 lbs. w.p.
5000 lbs. w.p.
10000 lbs. w.p.

and in "SA" stainless steel for corrosive conditions.

● No exposed threads, concealed seat in groove . . . no accidental damage. ● All metal seals . . . not affected by high or low temperature. ● Lubricators, bottom hole pressure adapters, and valves easily attached to Unibolt Tee. ● Tee cannot be accidentally opened. ● Unibolt stronger than tubing threads . . . ideal for working trees with welded lift nipple. Tubing threads in Tee if desired. ● Wing Valve requires no grease to effect seal. ● Variable opening speeds up initial clean-up or running initial flow tests . . . saves rig time. ● Unrestricted 1" opening in Wing Valve will pass 10,000 bbls. fluid per day with 100 lbs. pressure drop. ● Valve stem packing needs no tightening . . . stem turns freely under high pressures. ● Threads on stem not exposed to internal or external damage . . . full 2½" pilot for true stem alignment and rigidity. ● Stem seat sealed by power threads and metal gasket assures alignment. ● Nitride hardened stem and stem seat . . . resists corrosion. ● Choice of hard chrome plated or "SA" stainless stems and seats. ● Positive Choke Body takes regular or "X" Beans . . . all beans flow-rated. ● Shaped entrance on beans prevents paraffin clogging. ● Positive Choke Body may be replaced with inexpensive tee and cage nipple, or can be converted to Adjustable Wing Valve by substituting two parts. ● Streamlined flow . . . no obstructions . . . no turbulence.

THORNHILL
P. O. BOX 1184

UNIBOLT

CRAVER CO.
HOUSTON, TEXAS

You can get D+B

No Wonder
More and More
Experienced Operators
Demand D+B Pumps,
D+B Parts and D+B
Pump Shop Service—
Backed by 50 Years
of Know-How

Complete flexibility and adaptability to any type of job —deep or shallow—under sandy, corrosive, gassy, crooked or slant hole conditions is available with D+B Precision-Built Pumps, which can be "customized" for your needs from standard D+B Parts. Get the full story from your nearest Continental-Emsco Store and learn about prompt pump shop service available in every major producing field.

CONTINENTAL-EMSCO

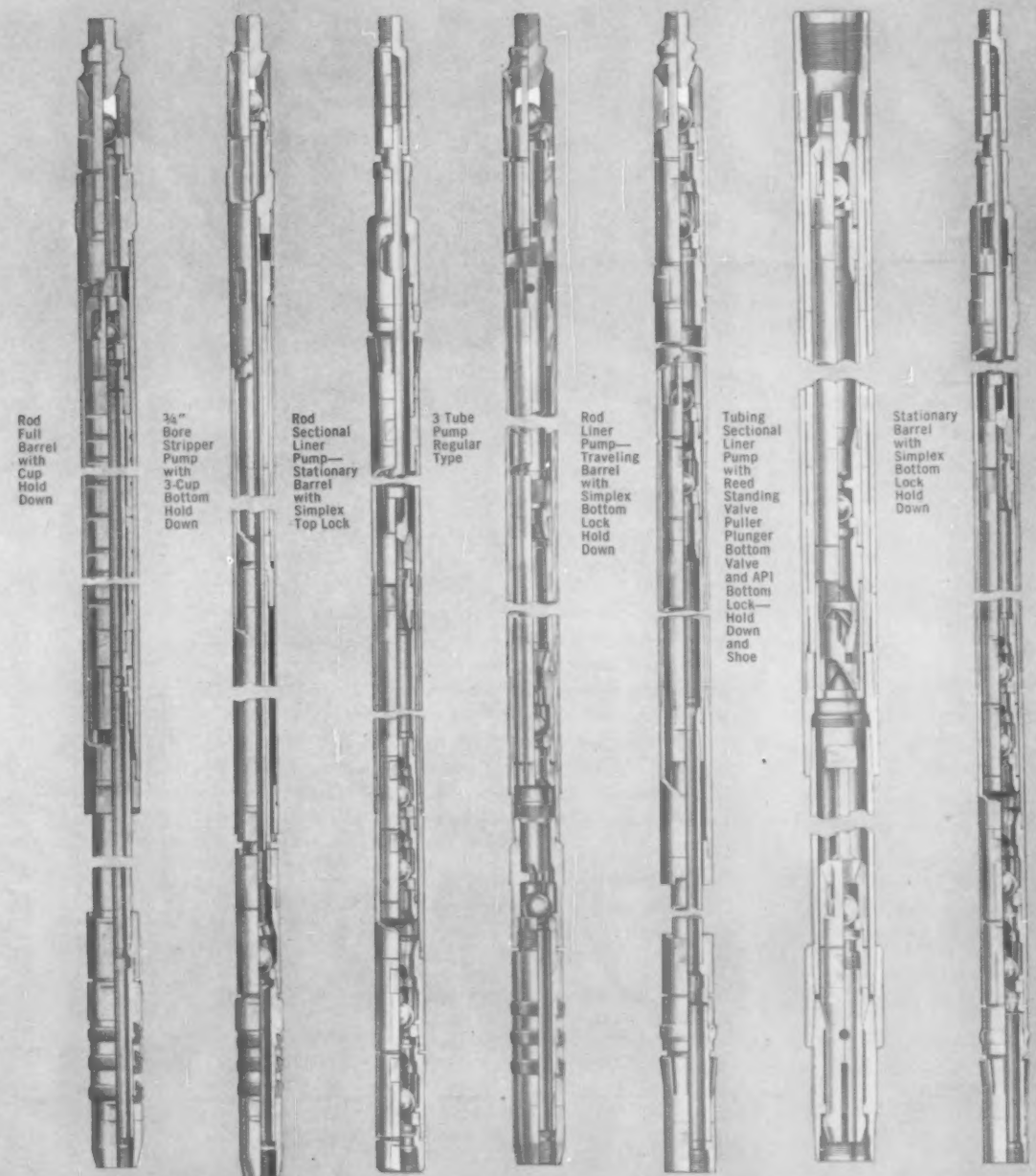
Serving the Oil and Gas Industries ... Worldwide

D+B
- DEEP WELL PUMPS
- SUCKER RODS
- COUPLINGS

CONTINENTAL-EMSCO COMPANY
A Division of The Youngstown Sheet and Tube Company
General Offices: DALLAS, TEXAS • Plants: LOS ANGELES • HOUSTON • GARLAND, TEXAS
Export Division: 45 Rockefeller Plaza, New York, N. Y.
Representatives in All Principal Oil Fields of the World

"CUSTOMIZED" PUMPS

made in 700 combinations from standard **D+B** *parts to fit your needs!*


Rod Full Barrel with Cup Hold Down
¾" Bore Stripper Pump with 3-Cup Bottom Hold Down
Rod Sectional Liner Pump—Stationary Barrel with Simplex Top Lock
3 Tube Pump Regular Type
Rod Liner Pump—Traveling Barrel with Simplex Bottom Lock Hold Down
Tubing Sectional Liner Pump with Reed Standing Valve Puller Plunger Bottom Valve and API Bottom Lock—Hold Down and Shoe
Stationary Barrel with Simplex Bottom Lock Hold Down

P-701

LARGER SIZE RANGE

MIDWEST ELBOWS

IMPROVED DELIVERY

HEAVY WALL CARBON STEEL AND ALLOY

12" Long Radius
2¼" Wall Thickness
1¼% Chrome

20" x 10" Reducing
2" Wall Thickness
2¼% Cr—1% Mo.

STRAIGHT LONG RADIUS 90° ELLS

Nominal Pipe Size	Maximum Wall Thickness
36	1.250
30	2.000
26	2.000
24	1.500
20	1.375
18	2.250
16	2.125
14	1.750
12	2.000
10	2.000
8	1.750
6	1.000
5	.625
4	.750
3	.625
2½	.375
2	.500

These straight elbows can be furnished with LONG TANGENTS at no extra cost. All thicknesses less than those shown above are, of course, available.

The exclusive Midwest method of making all welding elbows from plate instead of tubing gives us a FLEXIBILITY OF MANUFACTURE that is much greater than by any other process. These heavy wall Midwest straight and reducing elbows are available in any material that can be secured as plate. The maximum wall thicknesses for which we now have equipment are indicated by the tables at left and right. And, because it is easier to get plate than tubing, better delivery is another advantage. Still another is the close tolerances inherent in our process.

Quality control goes beyond all code requirements. The longitudinal weld of every heavy wall elbow is completely X-rayed as standard procedure in our method of manufacture.

You will find it to your advantage to send us your inquiries.

REDUCING LONG RADIUS 90° ELLS

Nominal Pipe Size	Maximum Wall Thickness
30	2.000
26	*
24	2.000
20	2.000
18	2.000
16	1.500
14	1.750
12	2.250
10	2.000
8	1.750
6	1.000
5	.625
4	.750
3	.625
2½	.375
2	.500

Reductions to all nominal pipe sizes down to ½ large diameter. All thicknesses less than those shown above are, of course, available.
*Refer to factory.

MIDWEST PIPING COMPANY, INC.

Main Office: 1450 South Second St., St. Louis 4, Mo. • Plants: St. Louis, Clifton, N. J. and Los Angeles

Sales Offices

ASHEVILLE (BOX 446, SKYLAND, N.C.)
BOSTON 27—426 FIRST ST.
CHICAGO 3—79 WEST MONROE ST.
CLEVELAND 14—616 ST. CLAIR AVE.
HOUSTON 2—1213 CAPITOL AVE.
LOS ANGELES 33—520 ANDERSON ST.
MIAMI 34—2103 LE JEUNE RD.
NEW YORK 7—50 CHURCH ST.
ONEIDA, N.Y.—282 NORTH MAIN ST.
SAN FRANCISCO 11—420 MARKET ST.

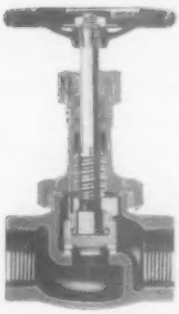
STOCKING DISTRIBUTORS IN PRINCIPAL CITIES

7675

Don't let LOW-QUALITY drain away YOUR *Maintenance* DOLLARS

The cost of a LUNKENHEIMER VALVE *Gets smaller... and smaller... and smaller...* with each passing year of dependable service.

The price you pay for the average valve represents only a fraction of its total cost. Every time a valve requires repair, more and more of your precious maintenance dollars are drained away. With today's high labor costs, it takes only one or two repair jobs to spiral maintenance expense up to a point many times higher than the original price of the valve. That's why it always pays to install the best valves your money can buy. When you insist on the extra margin of good workmanship and quality materials that go into Lunkenheimer Valves, you get your investment back many times over in trouble-free, maintenance-free service. The Lunkenheimer Company, Cincinnati 14, Ohio.



There's a cost-minded Lunkenheimer Distributor in your area. Let him show you how Lunkenheimer quality can contribute to valve maintenance savings in your plant. And be sure to check the amazing performance records of LQ600, with patented Brinalloy® seats and discs.

L-357-18

- BRONZE
- IRON
- STEEL
- PVC

LUNKENHEIMER®

THE ONE *Great* NAME IN VALVES

THE FULLEST MEASURE OF SERVICE

Our company has often been called the leading independent petroleum research organization. This may be true, as far as it goes, but it falls far short of a true description of our function in the great petroleum industry. In the broad sense, UOP is a *service* organization operating on the basic objective of improving petroleum refining technology in order to help any refiner better his operating and economic position by producing a larger volume of higher quality petroleum products from each barrel of oil he processes. The attainment of this objective encompasses a wide field of endeavor.

It all starts in our laboratories. Here, in an ideal research atmosphere, scientists and technicians search out that elusive new idea that will provide a better and more efficient refining process or method.

We may follow many unfruitful paths and carry out diverse experiments until we find a promising approach. Then it is analyzed and evaluated by UOP's top-flight group of scientists and engineers. This expert consideration determines the practical importance of the theory. This application is then carefully developed in exhaustive pilot plant investigations. Standard facilities are maintained for this or special ones developed as necessary. These pilot plant studies also give helpful design data and cost information on plant construction and product manufacture.

When proved, the new process becomes available for license by any refiner, anywhere.

We realize fully our responsibility to provide the licensee with the pattern to make UOP processes work in practical commercial operation. Our process engineers, our designers and other technical specialists render a complete detailed design of the commercial process unit.

Having designed the equipment to make the process work, we do all we can to make sure that the plant built for the process will perform efficiently. So we make available to our licensees experienced UOP engineers to supervise its construction.

Regardless of the quality of the design and construction, it still takes people to run a refinery.

TO THE OIL REFINING INDUSTRY

That's why we provide a comprehensive instruction program for licensee plant operational personnel. This insures the know-how to make facilities and process work together properly.

We never forget our customers. To help the refiner maintain his plant at the top level of safety, efficiency and profitability we offer the on-the-spot assistance of our experienced engineers and inspectors.

Beyond this basic development and servicing of UOP processes we provide a variety of laboratory services to our licensees and customers in the petroleum refining industry. These include evaluation of crudes, product examinations, analyzation of automotive, jet and diesel fuels and other materials important in the day-to-day operation of a refinery.

Beyond its development, design and service functions, Universal appreciates the problems inherent in the constantly changing economics of manufacturing and marketing. Therefore it offers the services of its experienced Market Research and Economics Group.

Through forty years, the world around, Universal has been responsible for the development of many of the most important refining processes now in use. Even more important, we believe, is the broad and thorough measure of service we have consistently provided the users of our processes to assist them in making products from petroleum economical to manufacture and profitable to market at prices within easy reach of every man's purse.

UOP®

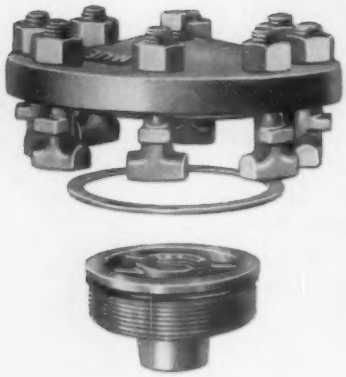
Forty Years Of Leadership In Petroleum Refining Technology

UNIVERSAL OIL PRODUCTS COMPANY

30 Algonquin Road
Des Plaines, Illinois, U. S. A.

MUELLER®

"NO-BLO® tee gives fast, safe tie-in"



H-17505 Flanged Tee.
230 p.s.i. working pressure
at 100°F.
Sizes 3", 4", 6", 8".

Tie into steel lines under pressure—without interrupting flow or losing fluid — with the Mueller Flanged Tee. Forged-steel tee has similar analysis to pipe line, assuring easy weldability on inlet and outlet. 150, 300, 400 and 600-pound flanges withstand operating pressures up to 1200 p.s.i. Tee can be installed under operating pressures up to 500 p.s.i. at 100° Fahrenheit or 250 p.s.i. at 500° Fahrenheit with the Mueller power-operated C-1 Drilling Machine.

Cut into the line is made through the tee with Mueller equipment. Completion plug with "O" ring seal is inserted into tee through a gate valve to provide positive seal against leakage. Completion plug has internal equalizing valve which balances pressure on both sides of plug, assuring easy insertion into, or extraction from the tee while under pressure.

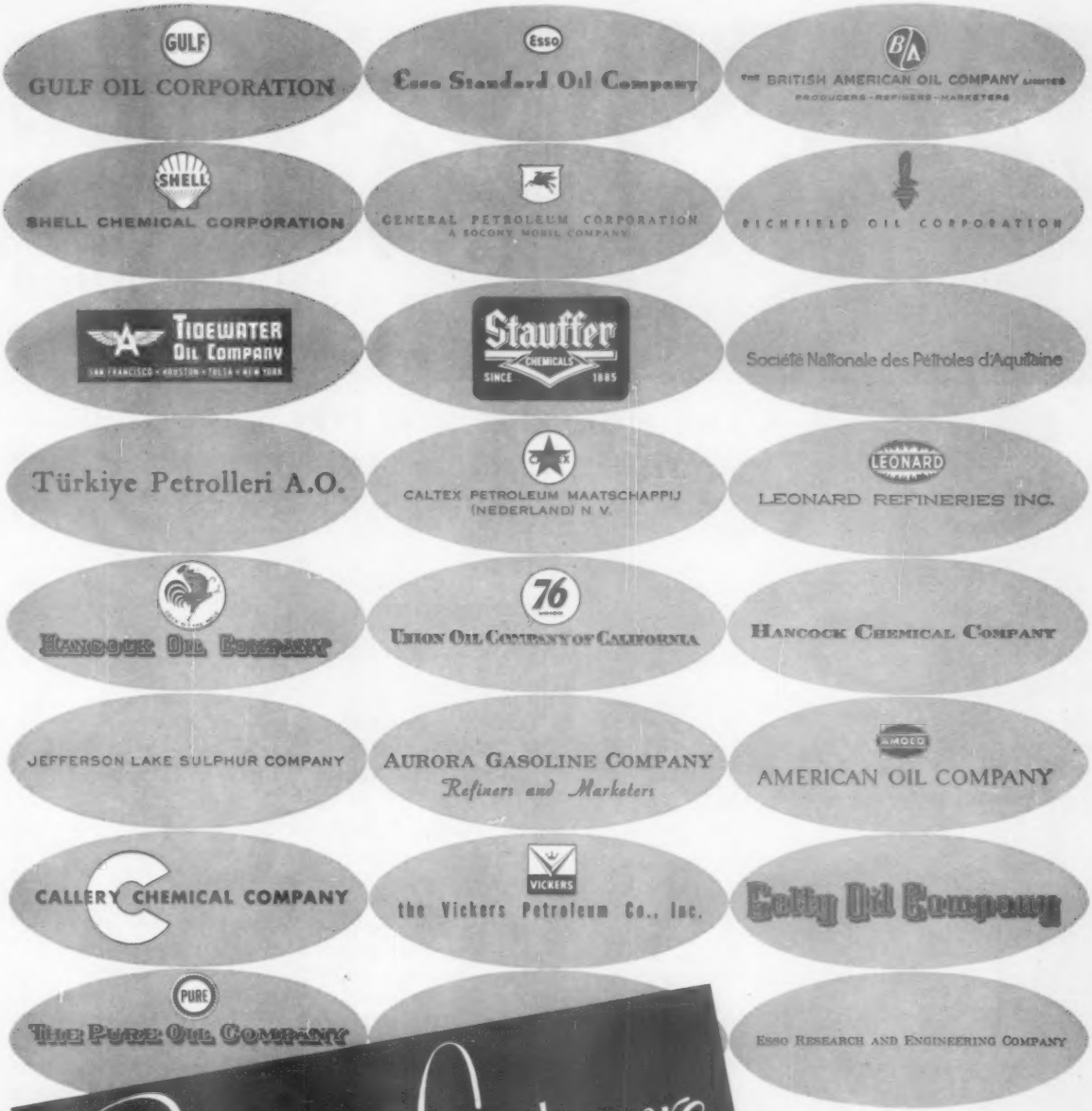
NO-BLO®

Write for complete information. A complete line of Mueller NO-BLO® products is available for making stop-offs, running temporary lines and making tie-ins under pressure.

MUELLER CO. **DECATUR, ILL.**

Factories at: Decatur, Chattanooga, Los Angeles.
In Canada: Mueller Limited, Sarnia, Ontario

Since 1857



Pride in our Customers

During the past year we have served some of the finest customers in the world. A few of them in the Petroleum and Chemical Industries are listed here. Our wish to all is continuing success.

PARSONS

THE RALPH M. PARSONS COMPANY

NEW YORK
PASADENA
WASHINGTON

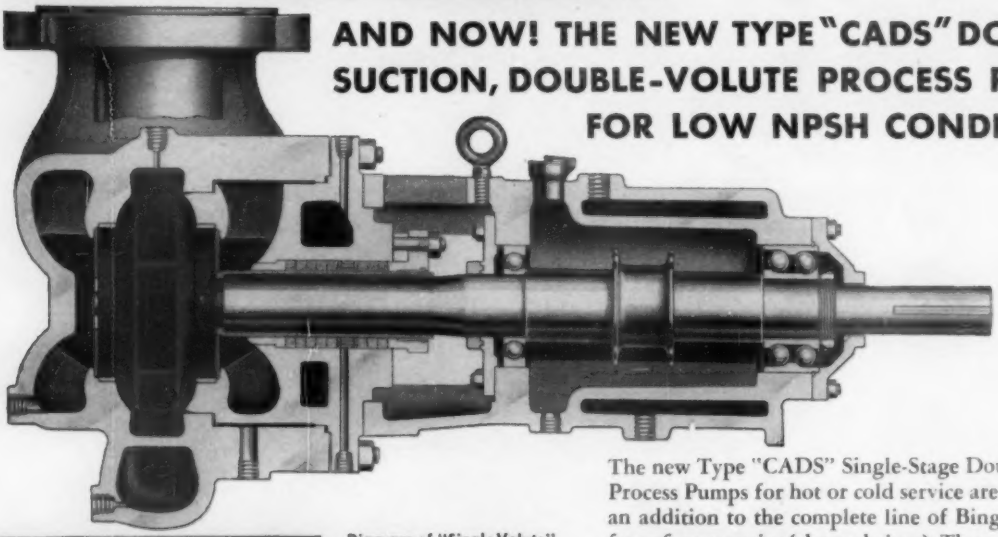
ENGINEERS • CONSTRUCTORS
LOS ANGELES

ANKARA
BAGHDAD
BEIRUT
JEDDAH
KARACHI
NEW DELHI
PARIS

Bingham REFINERY PUMPS

designed HOT or including

AND NOW! THE NEW TYPE "CADS" DOUBLE-SUCTION, DOUBLE-VOLUTE PROCESS PUMPS FOR LOW NPSH CONDITIONS



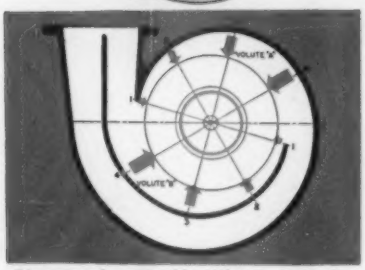


Diagram of a "Double Volute" single discharge case of a single stage pump (above), showing equal pressures on opposite sides of impeller. There is no "SIDE-PUSH"... insuring low maintenance.

Diagram of "Single Volute" pump case (below) showing unequal pressures at opposite points around the periphery of the impeller. These unequal pressures cause "SIDE-PUSH" on the rotating elements, causing wear of rotating parts and, frequently, high maintenance.

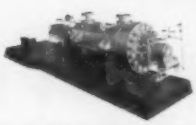
The new Type "CADS" Single-Stage Double-Suction Process Pumps for hot or cold service are available as an addition to the complete line of Bingham Pumps for refinery service (shown below). These new pumps, like other Bingham Process equipment, feature unit-type bearings and rotating assemblies which, with spacer-type couplings, are readily removable without disturbing suction or discharge piping, or drivers.

The new Type "CADS" has a "Double-Suction" impeller with exceptionally large eye areas, thus making it particularly suitable for low NPSH conditions. With a double suction impeller, the stuffingbox is under suction pressure only. The new Type "CADS" has been thoroughly field tested, and has rendered efficient, reliable service — with low maintenance — wherever it has been installed. Your nearest Bingham office will be glad to give you full details on request.

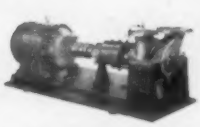
TYPICAL BINGHAM "DOUBLE VOLUTE"

Bingham Type HPD "Double Volute" Multi-Stage Double Case "Hi-Press" pump for extremely high pressure service.

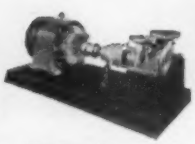
Bingham Type VS Single-Stage "Double Volute" Wet-Pit Pump for high capacity, medium head service.



Bingham Type CP "Double Volute" Multi-Stage, Double-Case pump for hot or cold service.



Bingham Type CKA "Double Volute" Single-Stage Koke-Krusher for coke-laden pumpage.



Bingham Type CAD "Double Volute" Single-Stage Process Pump.

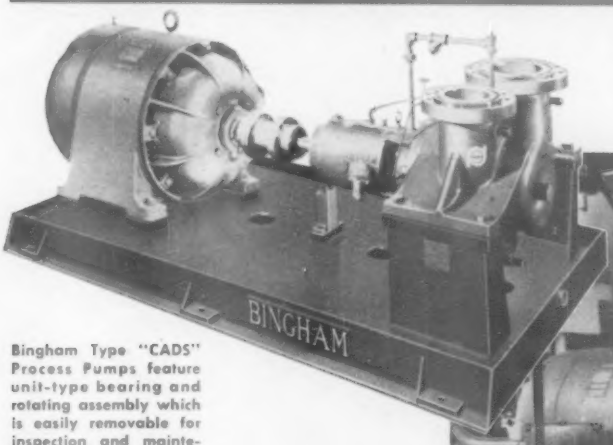
Bingham Type CM vertically split-case two-stage pump for hot service.

to meet all Operating Conditions for

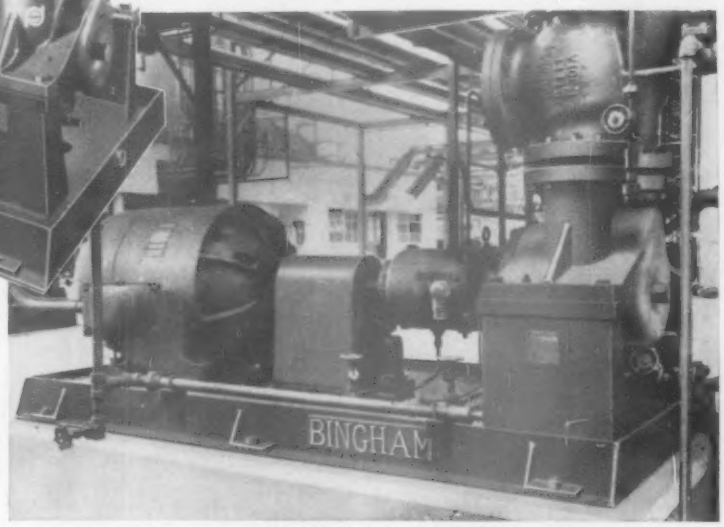
COLD HYDROCARBONS

minimum NPSH requirements

Bingham Type CADS Pumps are available in sizes to meet a wide range of heads and capacities, with low NPSH conditions.



Bingham Type "CADS" Process Pumps feature unit-type bearing and rotating assembly which is easily removable for inspection and maintenance.



One of a battery of Bingham Type "CADS" Pumps in operation at Gulf Oil Co., refinery, Port Arthur, Texas.

Bingham SINCE 1921

DOUBLE VOLUTE PUMPS RADIAL BALANCE

BINGHAM PUMP COMPANY

General Offices: **2800 N. W. Front Avenue, Portland 10, Oregon**

Factories: **Portland, Ore. • Vancouver, B. C., Canada**

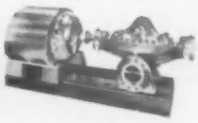
SALES AND SERVICE OFFICES

BOSTON, MASS.	NEW YORK CITY, N. Y.
CHICAGO, ILL.	PHILADELPHIA, PA.
CLEVELAND, OHIO	PITTSBURGH, PA.
DALLAS, TEXAS	SAN FRANCISCO, CALIF.
DENVER, COLO.	SEATTLE, WASH.
HOUSTON, TEXAS	ST. LOUIS, MO.
KANSAS CITY, MO.	ST. PAUL, MINN.
LOS ANGELES, CALIF.	TULSA, OKLA.
NEW ORLEANS, LA.	TORONTO, ONT., CAN.
	VANCOUVER, B. C., CAN.

PUMPS FOR EVERY REFINERY SERVICE

Bingham Type CD "Double Volute" Double Suction vertically-split case pump for hot service.

Bingham Type CJ "Double Volute" Two-Stage Process Pump for high heads.

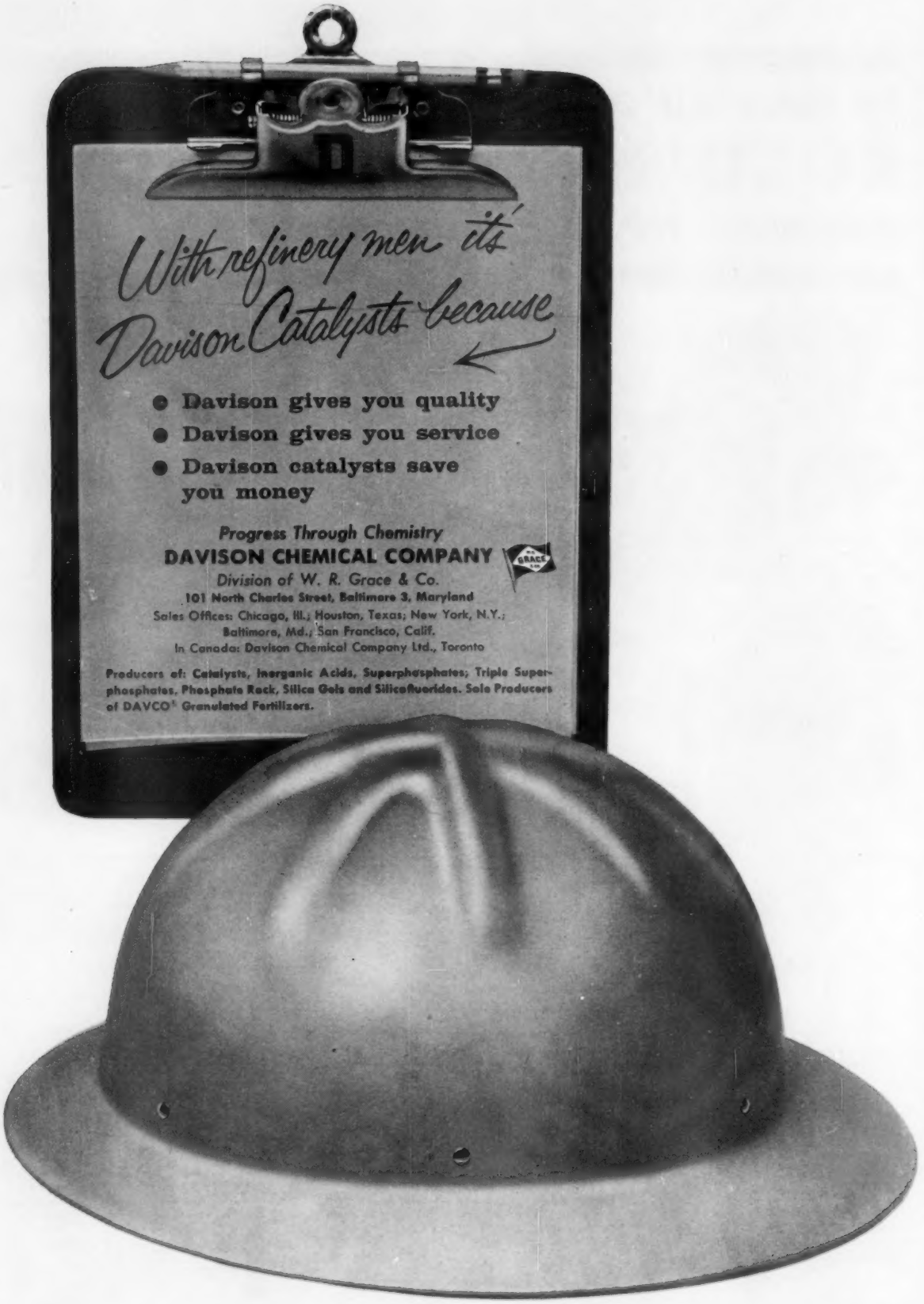


Bingham Type HSB "Double Volute" Double Suction Pump for high heads.

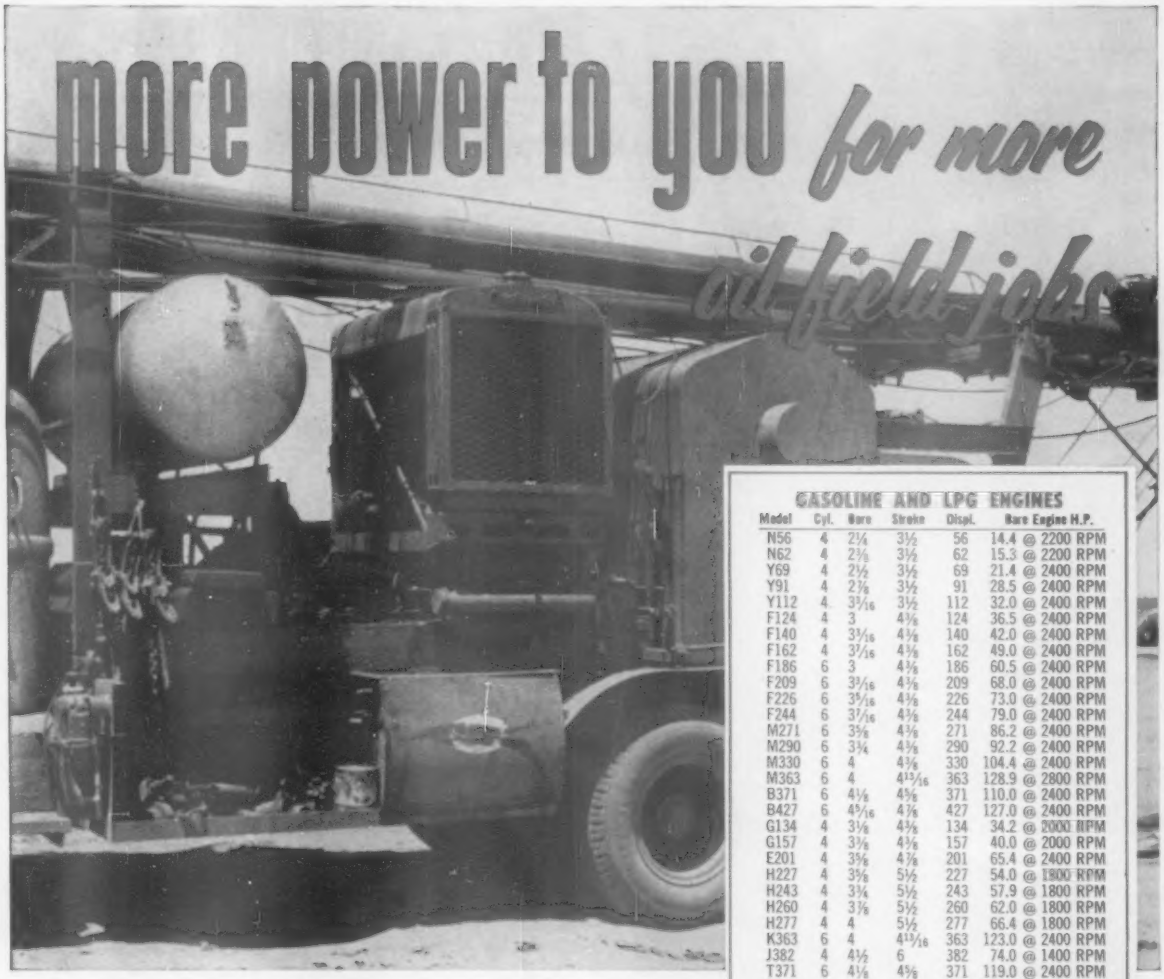
Bingham Type MSB Horizontally Split-Case "Double Volute" Multi-Stage Pump for high pressure hot or cold service.

Bingham Type KT Stuffing-boxless Pump for high suction pressures and cold service.

Bingham Type VCP Vertical Pump for low NPSH conditions, featuring bottom dismantling.


With refinery men it's
Davison Catalysts because
● Davison gives you quality
● Davison gives you service
● Davison catalysts save you money
Progress Through Chemistry
DAVISON CHEMICAL COMPANY
GRACE
Division of W. R. Grace & Co.
101 North Charles Street, Baltimore 3, Maryland
Sales Offices: Chicago, Ill.; Houston, Texas; New York, N.Y.; Baltimore, Md.; San Francisco, Calif.
In Canada: Davison Chemical Company Ltd., Toronto
Producers of: Catalysts, Inorganic Acids, Superphosphates; Triple Superphosphates, Phosphate Rock, Silica Gels and Silicofluorides. Sole Producers of DAVCO® Granulated Fertilizers.

more power to you *for more oil field jobs*



All through the oil fields, you'll find abundant proof of the stamina that has made Continentals first choice for so many tough jobs. The Wichtex service unit pictured here, powered by Continental Red Seal closed power unit, is operated by the Wilcox Well Service Company of Rule, Texas. . . . . The petroleum industry's widening use of Red Seal engines and power units traces mainly to two factors. One is the broad diversification of the Red Seal line, with more than 100 basic models at closely-spaced power levels, and the other is Continental's long standing reputation for dependability—their inbuilt capacity to deliver more power, longer, at lower cost. . . . . Ask your oil field supply store or get in touch with the nearest Continental Office.

• • •

GASOLINE AND LPG ENGINES

Model	Cyl.	Bore	Stroke	Displ.	Bare Engine H.P.
N56	4	2¼	3½	56	14.4 @ 2200 RPM
N62	4	2⅜	3½	62	15.3 @ 2200 RPM
Y69	4	2½	3½	69	21.4 @ 2400 RPM
Y91	4	2⅞	3½	91	28.5 @ 2400 RPM
Y112	4	3 5/16	3½	112	32.0 @ 2400 RPM
F124	4	3	4⅛	124	36.5 @ 2400 RPM
F140	4	3 1/16	4⅛	140	42.0 @ 2400 RPM
F162	4	3 7/16	4⅛	162	49.0 @ 2400 RPM
F186	6	3	4⅛	186	60.5 @ 2400 RPM
F209	6	3 1/16	4⅛	209	68.0 @ 2400 RPM
F226	6	3 5/16	4⅛	226	73.0 @ 2400 RPM
F244	6	3 7/16	4⅛	244	79.0 @ 2400 RPM
M271	6	3⅝	4⅛	271	86.2 @ 2400 RPM
M290	6	3¾	4⅛	290	92.2 @ 2400 RPM
M330	6	4	4⅛	330	104.4 @ 2400 RPM
M363	6	4	4 13/16	363	128.9 @ 2800 RPM
B371	6	4⅛	4⅝	371	110.0 @ 2400 RPM
B427	6	4 5/16	4⅞	427	127.0 @ 2400 RPM
G134	4	3⅛	4⅛	134	34.2 @ 2000 RPM
G157	4	3⅛	4⅛	157	40.0 @ 2000 RPM
E201	4	3⅜	4⅞	201	65.4 @ 2400 RPM
H227	4	3⅝	5½	227	54.0 @ 1800 RPM
H243	4	3¾	5½	243	57.9 @ 1800 RPM
H260	4	3⅞	5½	260	62.0 @ 1800 RPM
H277	4	4	5½	277	66.4 @ 1800 RPM
K363	6	4	4 13/16	363	123.0 @ 2400 RPM
J382	4	4½	6	382	74.0 @ 1400 RPM
T371	6	4⅛	4⅝	371	119.0 @ 2400 RPM
T427	6	4 5/16	4⅞	427	140.0 @ 2400 RPM
U501	6	4½	5¼	501	159.0 @ 2400 RPM
R513	6	4½	5⅛	513	164.3 @ 2400 RPM
R572	6	4¾	5⅛	572	182.4 @ 2400 RPM
R602	6	4⅞	5⅛	602	191.7 @ 2400 RPM
V603	8	4¼	4¼	603	220.0 @ 2800 RPM
S749	6	5⅛	5½	749	217.0 @ 2200 RPM
S820	6	5⅝	5½	820	237.0 @ 2200 RPM

CUSHIONED POWER DIESEL ENGINES

Model	Cyl.	Bore	Stroke	Displ.	Bare Engine H.P.
ZD129	4	3¼	3⅞	129	34.0 @ 2000 RPM
GD157	4	3⅜	4⅛	157	39.0 @ 2000 RPM
*ED201	4	3⅝	4⅞	201	45.8 @ 2000 RPM
HD243	4	3¾	5½	243	55.0 @ 2000 RPM
*HD260	4	3⅞	5½	260	59.0 @ 2000 RPM
*HD277	4	4	5½	277	63.2 @ 2200 RPM
*JD382	4	4½	6	382	72.5 @ 1600 RPM
TD427	6	4 5/16	4⅞	427	106.0 @ 2000 RPM
RD572	6	4¾	5⅛	572	154.0 @ 2000 RPM
VD603	8	4¼	4¼	603	175.0 @ 2600 RPM
SD802	6	5 9/16	5½	802	202.0 @ 1800 RPM

*Available for industrial applications only.

SERVICE FACILITIES AND GENUINE RED SEAL PARTS AVAILABLE EVERYWHERE

CONTINENTAL MOTORS ® Powerful as the Nation AMERICA'S STANDARD

Continental Motors Corporation

MUSKEGON, MICHIGAN

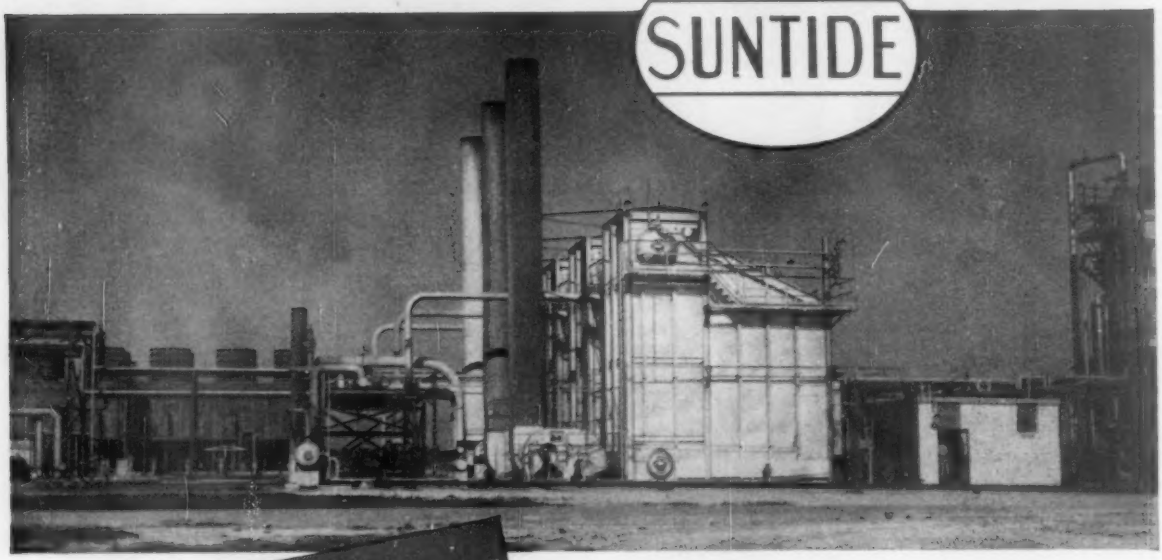
6 EAST 45TH STREET, NEW YORK 17, NEW YORK • 6218 CEDAR SPRINGS ROAD, DALLAS 9, TEXAS • 3817 SOUTH SANTA FE AVENUE, LOS ANGELES 58, CALIFORNIA • 1252 OAKLEIGH DRIVE, EAST POINT (ATLANTA) GEORGIA

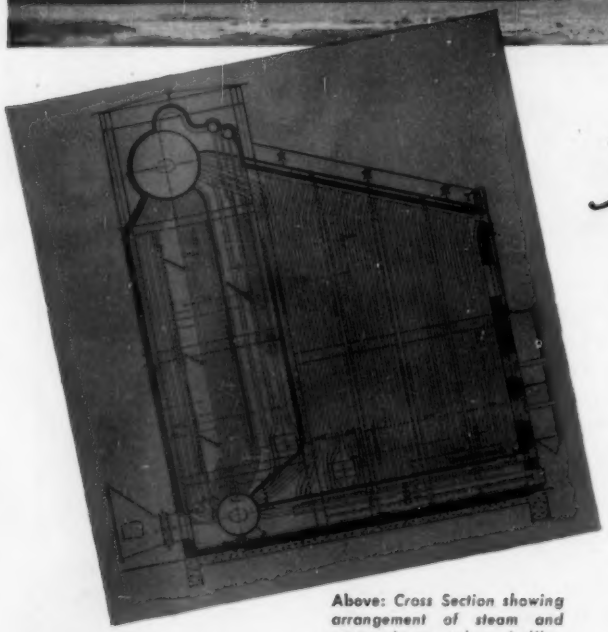
GOOD EQUIPMENT IS BETTER WITH CONTINENTAL RED SEAL POWER

Vogt STEAM GENERATORS

at SUNTIDE REFINING COMPANY

Viola, Texas





Above: *Cross Section showing arrangement of steam and water drums, tubes, baffles, and furnace.*

3 Units Installed
2 Units on Order

Principle Data Each Unit

- 85,000 pounds steam per hour capacity, designed for 500 lbs. S.W.P. and 625° F. total temperature.
- Water cooled furnace.
- Burners for Gas and Oil fuel.

Vogt offers a complete line of custom built and package type steam generators. Available in bent tube and straight tube designs for solid, liquid, or gaseous fuels burned singly or in combination.

Write for bulletins, Dept. 24A-BO

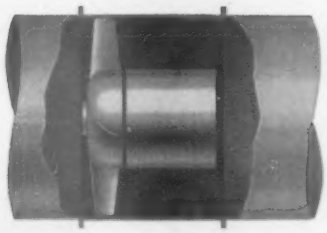
OTHER VOGT PRODUCTS

Drop Forged Steel Valves, Fittings and Flanges—
Petroleum Refinery and Chemical Plant Equipment
Heat Exchangers
Ice Making and Refrigerating Equipment

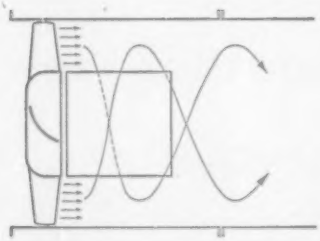
HENRY VOGT MACHINE CO.

Box 1918, Louisville 1, Kentucky

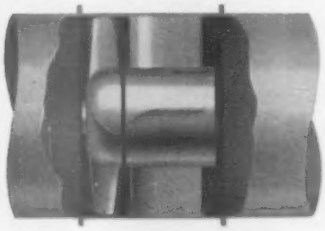
SALES OFFICES: New York, Chicago, Cleveland, Dallas, Philadelphia, St. Louis, Charleston, W. Va., Cincinnati



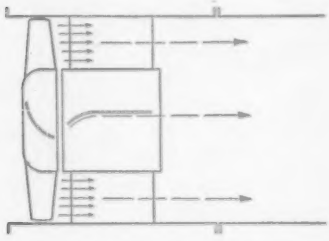
The tubeaxial fan . . . a wide range of volumes at medium pressures, with uniform velocity . . .



. . . at moderate pressures the spiral air discharge straightens out a short distance from fan blades.

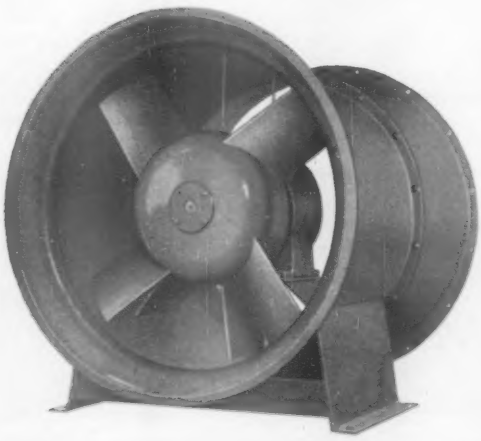


The vaneaxial fan . . . stationary guide vanes reduce turbulence and increase fan efficiency . . .



. . . resulting straight-line air flow leaving fan assures smooth, quiet operation for all conditions.

Easy-to-install American Blower axial fans save space, lower your installation cost



Versatile American Blower axial fans can be mounted vertically or horizontally. When ducts are properly reinforced, the fan can be supported directly by the duct connection.

American Blower axial fans provide straight-line air flow, eliminating elbows, bends, and transformation pieces—can be installed vertically or horizontally in ducts, with minimum foundations and supports . . . with savings in space, first cost, handling, and installation.

These compact, self-contained axial fans are available in three general designs—vaneaxial for direct and V-belt drive, spray-booth vaneaxial for V-belt drive, tubeaxial for direct drive. A complete line of accessories is offered to adapt this versatile line of fans to your particular requirements. Capacities range from 2,500 cfm to 75,000 cfm. Larger sizes are available on special order.

For more information on axial fans, or on other equipment from American Blower's complete air-handling and -conditioning line, call our nearest branch office, or write direct to American Blower Division of American-Standard, Detroit 32, Michigan. In Canada: Canadian Sirocco products, Windsor, Ontario.

AMERICAN BLOWER

Division of American-Standard

New specialized off-highway V-8

Another reason why oil men find International Trucks cost least to own!

A new six-wheeler designed exclusively by INTERNATIONAL for heavy-duty off-highway work—with the most powerful truck-type engine in any comparable truck. Tough, husky construction to perform profitably under the most rugged conditions!

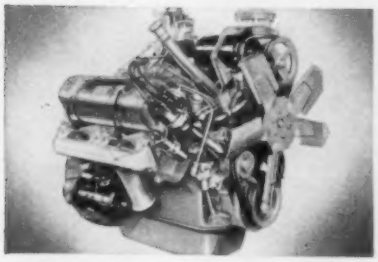
Here is more evidence of the INTERNATIONAL policy to build the trucks that operators want and need . . . trucks with only the highest quality components, the biggest selection of components to stay on the job longer at *least* cost. And INTERNATIONAL Trucks do cost *least* to own—fleet owners' cost records prove* this.

Why not get more proof yourself? See or call your INTERNATIONAL Dealer for all the facts. Do it today.

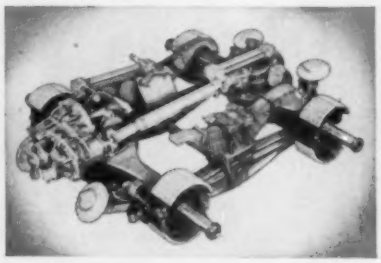
*Signed statements in our files, from fleet operators throughout the U.S., back up this statement.

INTERNATIONAL HARVESTER COMPANY, CHICAGO

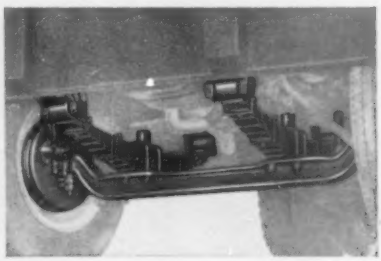
Motor Trucks • Crawler Tractors
Construction Equipment • McCormick® Farm Equipment and Farmall® Tractors



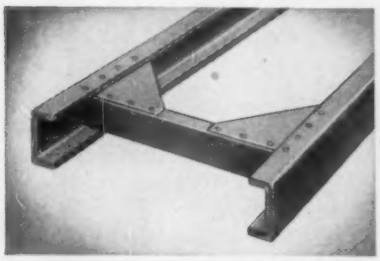
1 **Most V-8 power in any truck,** 257 hp. New VF-230 model has load-moving ability unlimited, power to haul the biggest loads anywhere. Other six-wheeler power plants include sixes and new V-8's—gasoline, LPG and diesel engines up to 356 hp.



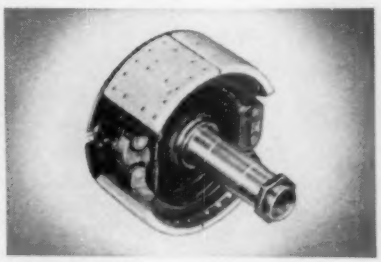
2 **INTERNATIONAL tandems give longer, more dependable life.** This heavy-duty, double reduction unit has 46,000 lbs. capacity. Sturdy cast steel housings. Third differential with lock transmits power smoothly, evenly to each axle.



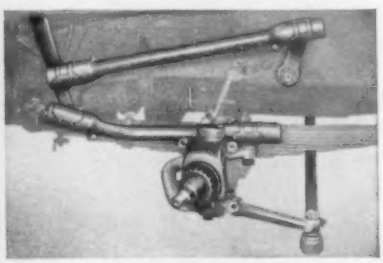
3 **Balanced heavy-duty front end** for maximum loading, added stability and longer life. 15,000 lbs. capacity heat-treated high carbon steel axles, 4-inch wide springs with threaded pins and bushings. Available on several other models.



4 **Steel-Flex frames** combine great strength with proper flexibility. New models have straight-through, double channels made of heat-treated alloy steel. Reinforced cross-members with husky gussets for sturdy, lasting tandem suspension.

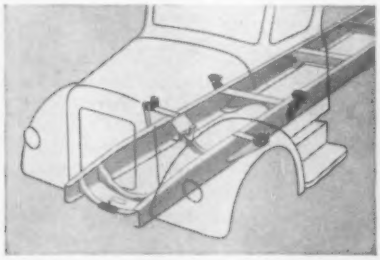


5 **Efficient, fast-acting air brakes** are standard on new VF-230 model—17½ in. x 3 in. front, 16½ in. x 7 in. rear with 1,162 sq. in. total lining area. Other six-wheel models with brake types and sizes to match the load and operation *exactly*.



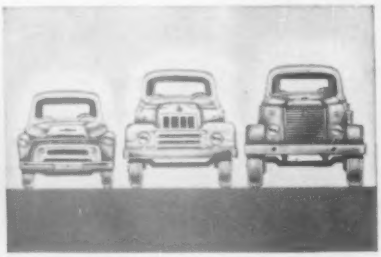
6 **True geometric steering** provides easier handling and outstanding maneuverability. **Heavy-duty gears** are cam and roller-mounted twin lever type. Controls mounted *ahead* of the front axle. Power steering standard on VF-230 model.

Latest addition to the world's most popular line of six-wheel trucks—new INTERNATIONAL Model VF-230 with 60,000 lbs. GVW. Built to absorb severe shock loads, to stand up under the most extreme applications. Engine is the industry's most powerful V-8, *257 hp.* Other new off-highway V-8 six-wheelers available, plus models from 22,000 to 76,800 lbs. GVW in conventional and COE design. Complete selection of all-wheel-drive models, too.



7 For cab comfort and long life. Quiet, level ride without transmitting stress to cab, fenders, hood or radiator. It's the result of wide spaced, rear shackle type mountings in an exclusive INTERNATIONAL 5-point, rubber-insulated cab suspension.

8 All-wheel drive models have the extra traction and pull needed for all tough, off-highway operations. Completely factory-built, 7,000 to 43,000 lbs. GVW. Low height with ample ground clearance. Complete selection of equipment available.



9 World's most complete line. There is an INTERNATIONAL "tailor-made" for every truck job, ½ tonners to 96,000 pounders. Choice of 4-wheel, 6-wheel and all-wheel-drive models, conventional and COE design. Every one built to cost *least* to own!

HOW IR REFINERY PUMPS

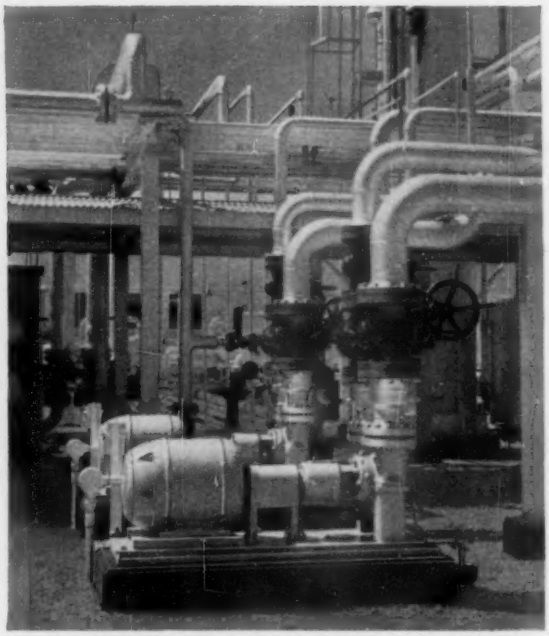
CUT DOWN-TIME • SAVE MAINTENANCE

Easy maintenance and less of it. These are important considerations in the design of every Ingersoll-Rand Refinery Pump. Here are some of the features that keep these pumps *on the job* longer, cut down-time and save maintenance costs.

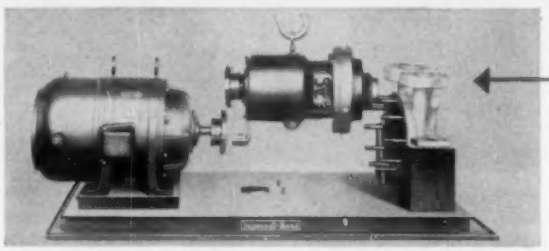
IMPELLER is carefully balanced for freedom from vibration. Made of bronze, iron or steel, for maximum service life under operating conditions. Impeller attached to shaft with pin-locked cap screw—can't work loose.

CASING is heavy-walled to provide corrosion allowance with conservative safety factor at maximum working pressure. Centerline support and water cooled stuffing box for hot liquid service to 800°F.

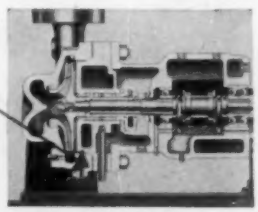
CASING LOCATING PIN, centered under casing, assures perfect pump alignment during high-temperature operation.



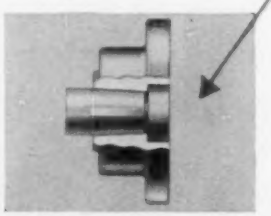
Two 1½" SFL pumps on reflux service at a natural gasoline plant.



Class SFL pump with coupling spacer removed, showing ease of disassembling pump unit.



Cross section of SFL pump



Ground, tapered coupling fit

SHAFT, of heat-treated carbon steel or stainless-steel, is fully ground and polished—held to close tolerances over entire length for perfect fit of replacement parts.

STUFFING BOX is deep enough to allow packing to be arranged to suit the application. Holds 8-10 rings, packed solid. Mechanical Shaft Seals can also be supplied.

SPLIT-TYPE GLAND is easy to remove from shaft. Smothering liquid can be circulated through gland when hazardous liquids are handled.

SPACER COUPLING permits quick, easy removal of entire pumping assembly without disturbing piping or driver.

TAPERED COUPLING FIT, with key and lock nut, eliminates need for shrink fit and permits easy removal or replacement.

For the complete story on I-R refinery and process pumps, send for your copy of Bulletin 7094B.

Ingersoll-Rand

10-417

11 BROADWAY, NEW YORK 4, N.Y.

PUMPS • CONDENSERS • ROCK DRILLS • GAS & DIESEL ENGINES • AIR & ELECTRIC TOOLS • VACUUM EQUIPMENT

It takes a complete team to keep dependable drilling mud service available for you

Meet this Magcobar Man, the barite plant worker who helps process millions of tons of Magcobar every year

He's supervising the separation, by Magcobar's original flotation process, of only the highest quality barite from native ore out of the Magnet Cove deposit. The Malvern, Arkansas plant, built in 1939, and still the model of processing plants, has the largest capacity of any single barite plant in the world. Continuous expansion, with modern innovations, keeps this plant operating at greater capacity every year. Other Magcobar barite plants are located at New Orleans, La.; Lake Charles, La.; Brownsville, Texas, and Battle Mountain, Nevada.

The ability to find and process more barite every year to meet the demands of the oil industry has distinguished the Magcobar organization since its inception.

In every Magcobar plant, good men are provided with modern plant facilities to insure you of an adequate supply of the finest quality drilling fluids in the oil fields.

MAGNET COVE BARIUM CORPORATION

Houston, Texas

Magcobar
Complete
DRILLING MUD SERVICE

Hose

MARKETING HOSE

Butane-Propane
Fuel Oil
Gasoline
Gasoline Pump
Grease
Lacquer Spray
Tank Unloading

TRANSPORTATION HOSE

Barge Unloading
Dock Unloading
Oil Suction & Discharge

PRODUCTION HOSE

Mud Pump Suction
Rotary Drilling
Slush Pump Suction
Vibrator

COUPLINGS AND ACCESSORIES

Aluminum Cast Nipples and Flanges
Detachable Couplings
Fuel Oil Hose Couplings
Gasoline Hose Couplings
One-Time Couplings
Tank Unloading Hose Couplings

GENERAL HOSE

Air Hose
Water Hose
Steam Hose
Fire Hose
Water Suction Hose
All-Purpose Hose

... stocked and sold by

J&L SUPPLY

Stocked in the Mid-Continent Area by JONES & LAUGHLIN STEEL CORPORATION, Supply Division P.O. Drawer 2481, Tulsa 2, Okla. and the J & L Store in YOUR field.

REPUBLIC RUBBER DIVISION
LEE RUBBER & TIRE CORPORATION, YOUNGSTOWN 1, OHIO
INDUSTRIAL RUBBER PRODUCTS

Stocked on the West Coast by HENDRIE BELTING & RUBBER CO. 405 Towne Ave., Los Angeles, Calif. PACIFIC COAST RUBBER COMPANY 51 Main St., San Francisco, Calif.

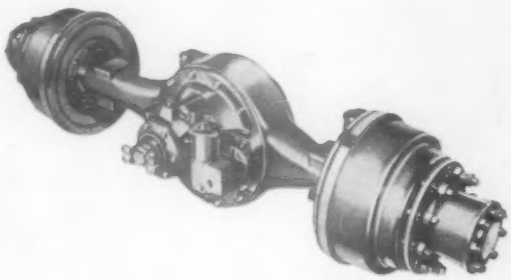
IN EATON 2-SPEED AXLES

REDUCES STRESS AND WEAR

ADDS TO AXLE LIFE • CUTS MAINTENANCE

KEEPS TRUCKS ON THE JOB • LOWERS OPERATING COST

Eaton's exclusive planetary construction distributes gear-tooth loads over four "planet" gears, holding stress and wear on any one gear tooth to a minimum. Completely locked out in the high speed range, these four gears rotate only slowly in the low speed range. The result is quiet operation, easy clash-free shifting, minimum wear, materially longer axle life. This rugged planetary design, plus forced-flow lubrication enables Eaton 2-Speeds to establish outstanding performance records. Eaton 2-Speeds also reduce stress and wear on engines and all power transmitting parts; they make it possible for trucks to haul more, quicker, longer, at lower cost.



More than Two Million
Eaton Axles in Trucks Today.
For complete information,
see your truck dealer.

EATON

AXLE DIVISION
MANUFACTURING COMPANY
CLEVELAND, OHIO

EATON® **PRODUCTS:** Engine Valves• Tappets• Hydraulic Valve Lifters• Valve Seat Inserts• Jet Engine Parts• Hydraulic Pumps Motor Truck Axles • Permanent Mold Gray Iron Castings • Forgings • Heater-Defroster Units • Automotive Air Conditioning Fastening Devices• Cold Drawn Steel• Stampings• Gears• Leaf and Coil Springs• Dynamatic Drives, Brakes, Dynamometers

A DAY

in the lives of a quarter of a million people

More than 240,000 people keep Cities Service, one of the world's largest oil companies, operating at full steam . . . 240,000 people who locate, produce, refine, improve, market and invest in the petroleum that constitutes any oil company's lifeblood.

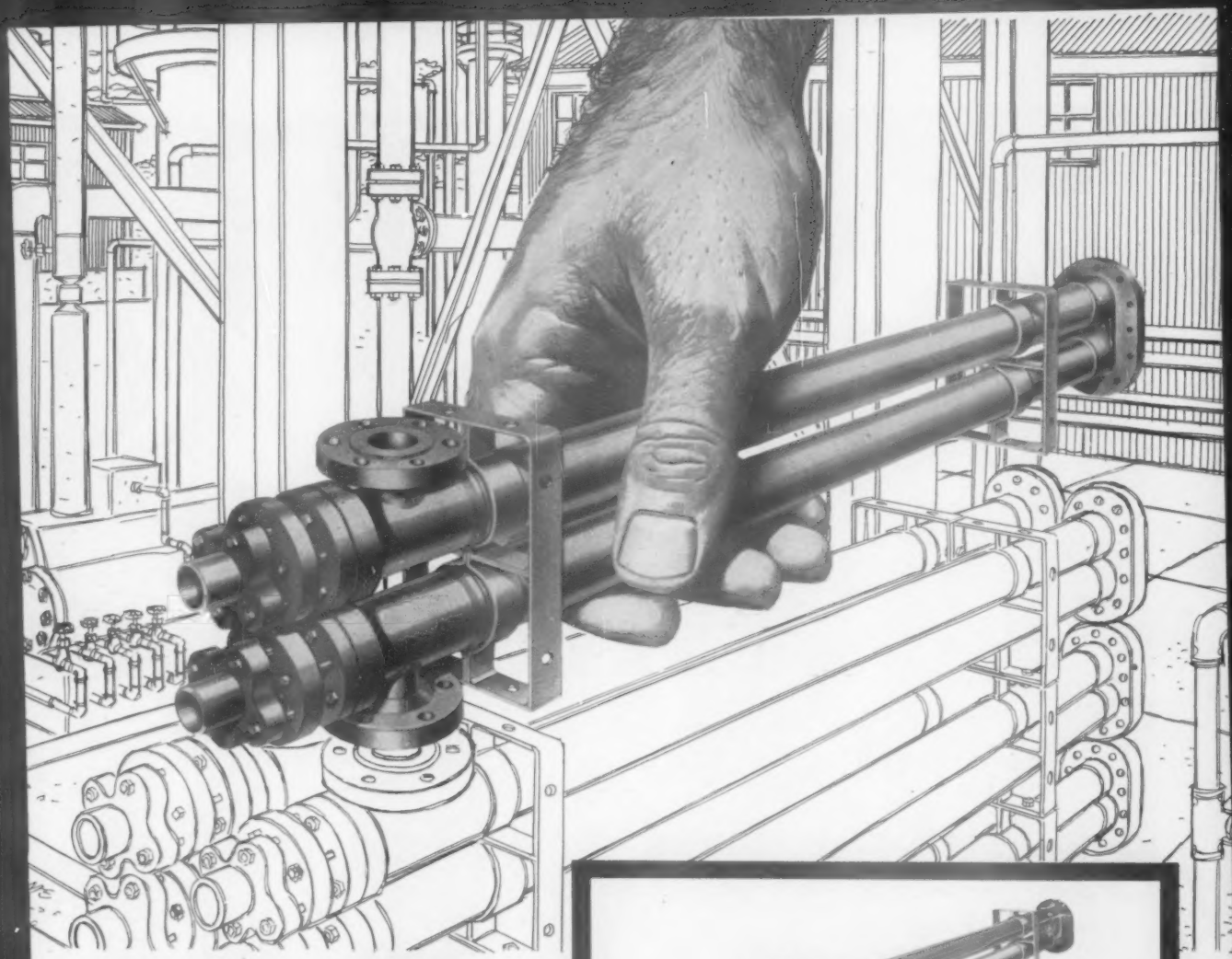
A winning team? Judge for yourself: Today, Cities Service is pushing forward in ever longer strides, with new refining facilities and techniques, new oil discoveries, new pipelines and tankers, new dealers, and new and improved petroleum products, unsurpassed in quality.

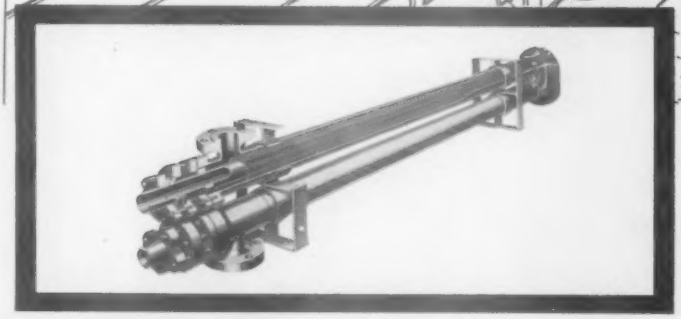
Moreover, the very fact that this surging activity exists, serves to assure further expansion . . . for healthy growth stimulates still more growth.

And significantly, this growth is more than the sign of a healthy company . . . it's living proof of a healthy country. For it again demonstrates the rich harvest of a system in which government, industry, and all citizens share an interest and an obligation toward each other.

CITIES SERVICE

Progress through Service





ALCOTWIN® Heat Exchanger

has building block flexibility

The ALCOTWIN's flexibility means that you can change load or processes within your plant, and still use the same heat-exchange equipment. ALCOTWINS can be easily added for increased load, rearranged for changing processes. They never become obsolete because of their unlimited number of applications. Further, ALCOTWINS are readily available. You can buy them "off the shelf" at ALCO's Beaumont, Texas, plant.

The ALCO gas shielded tungsten arc welding method of fusing the fins to the tube permits the widest possible range of metallurgy. The precise metallurgy needed for optimum results in your application can be selected in an ALCOTWIN. The many combinations of tube and fin materials available mean more efficient performance in high temperature services.

The ALCOTWIN furnishes real economy in first cost, in ease of installation and maintenance, and later on their unlimited adaptability prevents obsolescence, keeps your ALCOTWINS on the job.

Complete information is available from any of ALCO's sales offices. For a copy of Bulletin FH-3 write Petroleum Industry Equipment Division, Dept. AW-1, P. O. Box 1065, Schenectady 1, N. Y.

ALCO

ALCO PRODUCTS, INC.

NEW YORK

Sales Offices in Principal Cities

ALL 16 RIGS of the FWA Drilling Company use American Tiger Brand Wire Rope as a result of the service tests conducted by the contractor.

A. E. PETTY, Drilling Superintendent for FWA, who conducted tests. He says, "We've used American Wire Lines for a number of years and have never had any trouble."

Contractor gets 33% extra wire rope life since he changed to USS American Tiger Brand

The FWA Drilling Company of Wichita Falls, Texas wanted to find out for sure which drilling line gave the best service. Here's what they discovered, in the words of A. E. Petty, Drilling Superintendent: "We've tested a lot of different drilling lines and American Tiger Brand has given us an average of about 12,500 ton-miles on a 1550-foot line. Other ropes averaged about 9000 ton-miles. Tiger Brand gave about one-third *extra* service."

The American Tiger Brand Rope used in the test was 1⅛", 6 x 19 Monitor Excellay with wire core. The contractor followed the recommendations of the American Wire Rope sales engineer and cut back the ropes at regular intervals to get maximum service. They kept accurate ton-mile records on all ropes, and conditions were similar in each case.

Other contractors have obtained equally good results with American Tiger Brand Wire Lines—some even better! If you want longer life from your wire rope, call in our sales engineer and get his recommendations for setting up a program of wire rope care, or write for our new Tiger Brand Wire Rope book. There's no obligation.

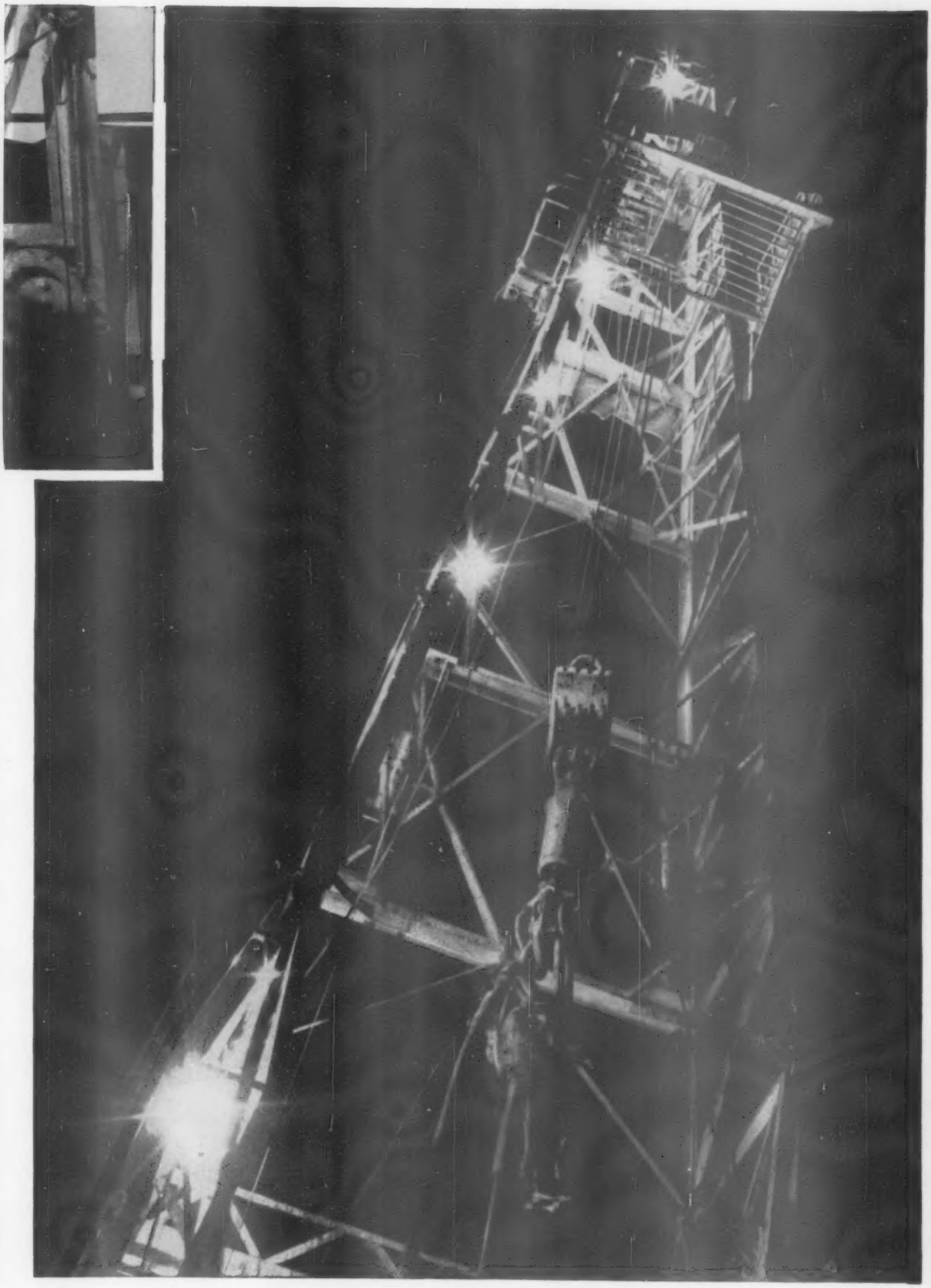
AMERICAN STEEL & WIRE
DIVISION

UNITED STATES STEEL, GENERAL OFFICES: CLEVELAND, OHIO • COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS AMERICAN TIGER BRAND WIRE ROPE

Excellay Preformed

UNITED STATES STEEL



Paint protection against rapid corrosion **inside your pipelines!**

In-place coating with Humble's epoxy internal pipe coatings gives you proven protection against rapid corrosion in sour crude oil, salt water and natural gas lines. These durable coatings can be applied in a single application to pipelines in the ground. In addition to giving lasting resistance to sour crudes and brine, Humble epoxy internal pipe coatings give a smooth, glossy finish that cuts down paraffin deposition.

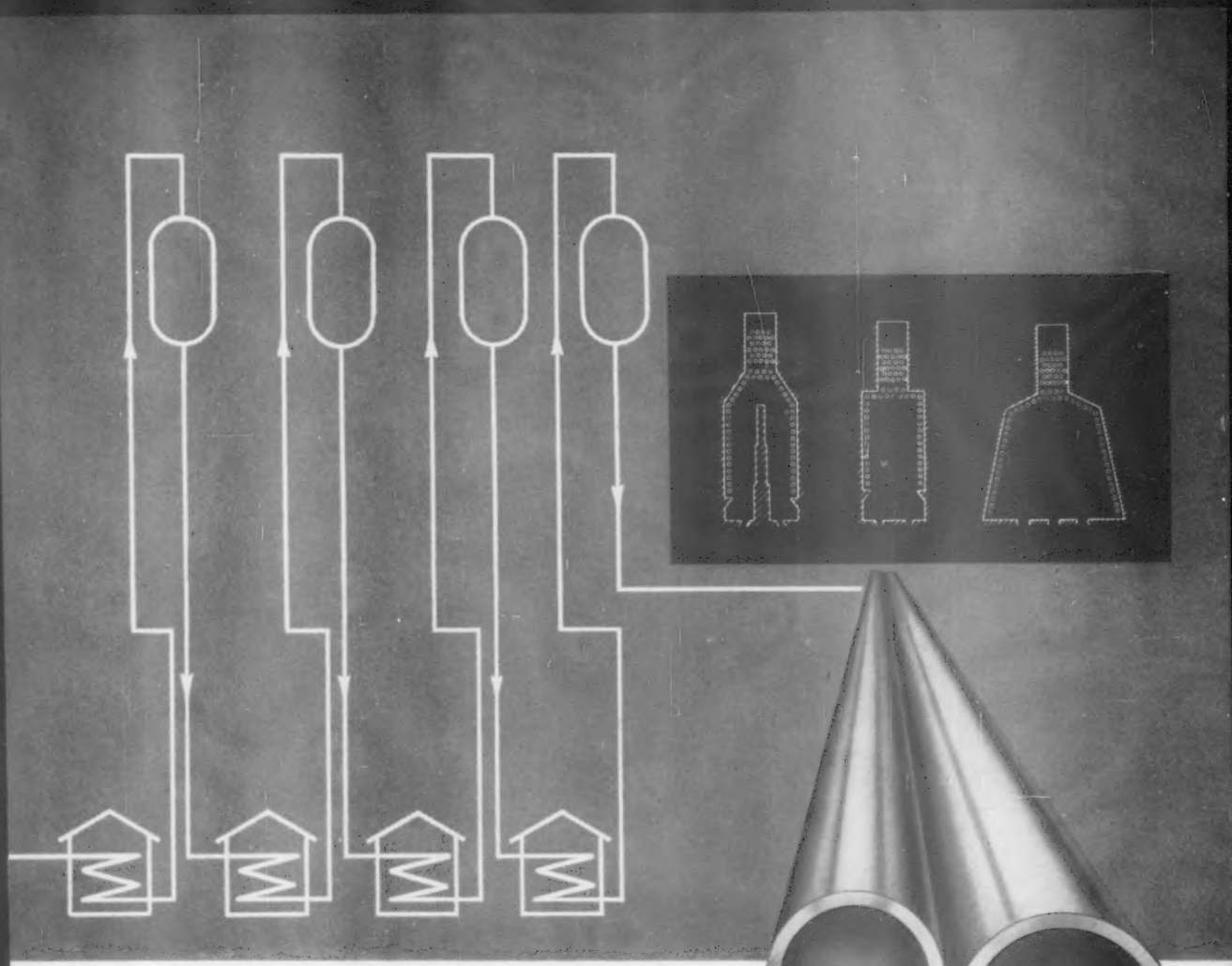
Humble internal pipe coatings are also available in vinyl and phenolic formulations.

For more information on Humble's complete line of protective coatings, see your nearest Humble wholesale plant in Texas and New Mexico, or write or phone:

HUMBLE OIL & REFINING COMPANY

HUMBLE

Technical Service
Sales Department
Humble Oil & Refining Company
P. O. Box 2180
Houston 1, Texas



HOW MANY PROBLEMS IN THIS PICTURE?

Some layouts present a multiplicity of engineering, purchasing, warehousing and financing problems. Conceivably, (1) Return bends have to be designed for a perfect fit on their heater tubes, (2) Both tubing and fittings must meet the same exacting customer standards, (3) Simultaneous delivery must be made to guarantee erection schedules, and (4) Money tied up in material in process at any one time must be kept to a minimum.

In such a situation, it's best to depend upon Mr. Tubes for coordinated delivery of perfectly matched tubing and fittings.

Think of your own requirements in terms of the right tube for the job, tubing (or alloy pipe) and welding fittings and forged steel flanges as components of an integrated system—and you'll make B&W's Mr. Tubes a member of your team. The Babcock &Wilcox Company, Tubular Products Division, Beaver Falls, Pa.

B&W

TUBULAR PRODUCTS DIVISION

TA-6085-PP-1

Seamless and welded tubular products, seamless welding fittings and forged steel flanges in carbon, alloy and stainless steels

Famous Wildcatter

The man at the machine is a craftsman.

And why shouldn't he be called a wildcatter?

His "drilling" equipment in this instance consists of a huge drill press boring machine and he's digging through metal rather than the Devonian.

But, the machinist puts skill and imagination into machines like this and works unexplored areas to turn out new products that will help the oil industry produce petroleum more efficiently, more economically.

Sure, he's a wildcatter!

And, he's typical of the craftsmen associated with the Oil Center Tool Company — expert machinists who pride themselves on their ability to produce the best, the latest in oilfield equipment at the precise moment of need.

The oil industry isn't composed just of the geologist with the map, the man at the drilling controls, the integrated companies, the shoestring operators, the twinkling of derrick lights in the night, the screaming protests of drillpipe being coupled, the white smoke signals from a steam rig.

The oil industry is much more than this.

The Oil Center Tool Company machinist is a vital part of the industry, too.

For, of what avail would the designs of the scientists be if there were not craftsmen to transform the blueprints into usable products?

But, a man is a wildcatter for reasons other than just a situation.

Sometimes destiny (or a well-executed idea backed up by lots of hard work and determination to excel) plucks a company out of the crowd. It becomes known for succeeding where others overlooked an opportunity.

To be a wildcatter, a man has to have a certain spirit.

That spirit defies precise definition.

Generally, however, it involves a desire to "be first."

That is what makes O-C-T craftsmen stand out—they have knowledge and equipment; but, coupled with that is a realization of the responsibility that is theirs and a resulting determination to be first with the best.

An O-C-T Christmas Tree doesn't stand hollowly alone.

There are many things in it.

Like the craftsmanship of O-C-T machinists, for example.

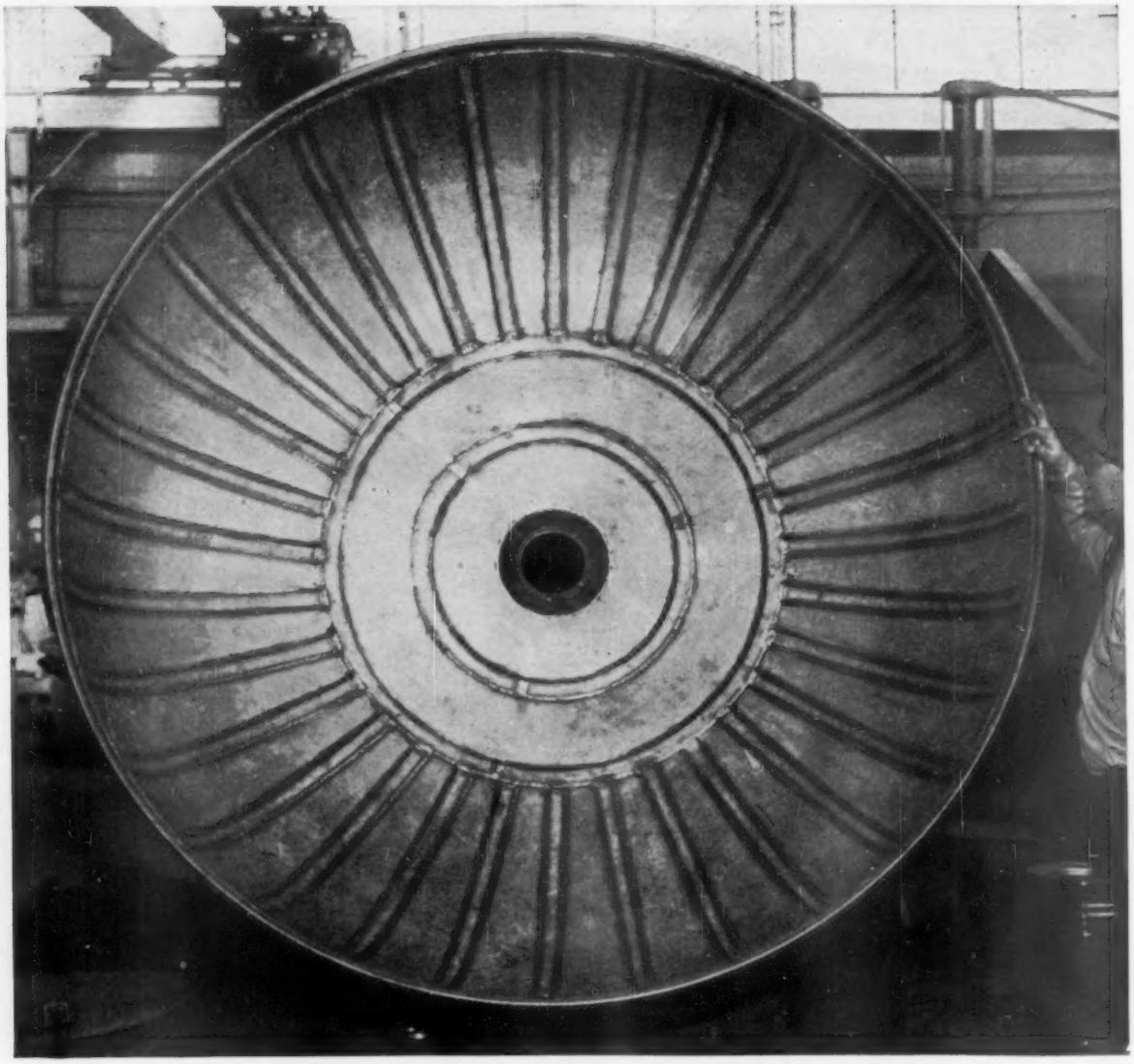
That's the strongest support you can have . . . for a Christmas tree or anything else.

O·C·T

OIL CENTER TOOL CO.

Export Representatives: South America — East West Oiltools, C. A., Del Lago Hotel, Maracaibo, Venezuela. Address Export Inquiries for All Other Countries to P. O. Box 3091, Houston, Texas.

This O-C-T machinist is operating a radial drill press, one of a number of new types of equipment the company employs in its Houston plant. O-C-T machinists are craftsmen and they are a basic part of the company's strength.



FLYING SAUCER?

Could be . . . considering the craftmanship

This skillfully fabricated head is part of an absorber tower for the production of polyethylene. Of carbon steel with a carefully applied Hastelloy lining, it has proved very resistant to the highly corrosive reactions of gaseous chemicals under conditions of high temperature and pressure. For long-lasting equipment under exacting service conditions, Graver is a reliable source of skilled craftmanship.

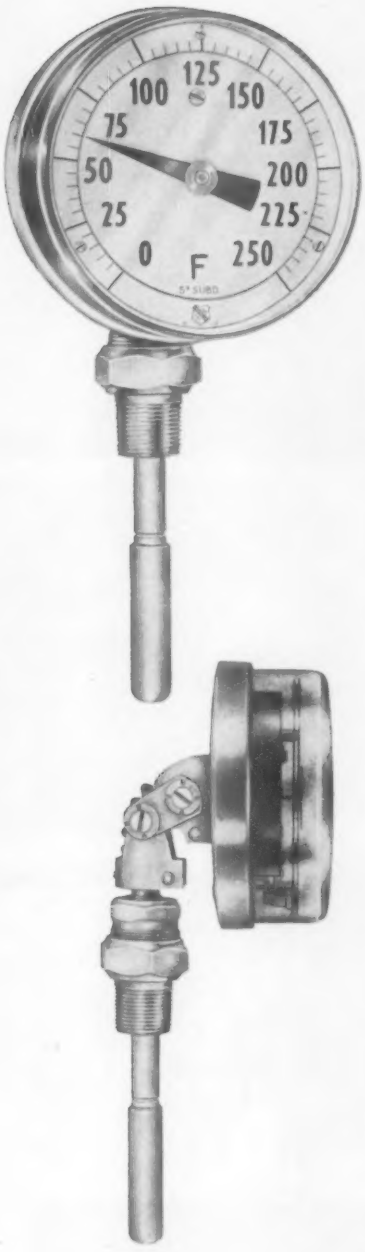
ALLOY DIVISION

1857-1957 GRAVER®

A CENTURY OF CRAFTSMANSHIP IN STEELS AND ALLOYS

GRAVER TANK & MFG. CO., INC.

EAST CHICAGO, INDIANA • NEW YORK • PHILADELPHIA • EDGE MOOR, DELAWARE
PITTSBURGH • DETROIT • CHICAGO • TULSA • SAND SPRINGS, OKLAHOMA
HOUSTON • LOS ANGELES • FONTANA, CALIFORNIA • SAN FRANCISCO



NEW

MERCURY ACTUATION

IN A MODERN 'AMERICAN'

"Every Angle" DIAL THERMOMETER

If you expect the most for your money in readability, accuracy and durability, here is the best dial thermometer investment you can make. The 'American' Mercury-Actuated "Every Angle" Dial Thermometer provides a combination of five major advantages found in no other thermometer:

"Every Angle" Set-ability. You can turn the dial to any angle within 180° on two axes. Whether installed above or below eye level – to the right or left of the reading point – you get easy face-to-face readings.

Fast, Accurate Indication. Mercury – one of the most sensitive heat transfer mediums – makes possible readings up to 1000° F. in a few moments with accuracy within 1% of the entire scale range.

Surest, Sharpest, Easiest Readings. The Maxivision® dial – a split-level dial – is constructed so that the graduations and pointer are on the same plane. No perspective effect. No parallax error in reading.

Best in Visibility. The cover is a large, durable, clear glass dome without bezel. No dark shadows dim the dial to hinder reading accuracy.

Stainless Steel Construction. Movement, capillary tubing, stem, case and cover mounting – all are stainless steel.

Where resistance to corrosion is important, where appearance and cleanliness are essential, the 'American' Mercury-Actuated "Every Angle" Dial Thermometer is ideal. It is rugged – has every quality required for the toughest services, indoors and outdoors. From the standpoint of economy, the "Every Angle" feature alone can save money in new piping specifications and when changing existing piping. It reduces the need to re-specify and stock a variety of fixed stem thermometers.

Dial Size: 4½". *Temperature Ranges:* –20/120° F. to 200/1000° F. *Stem Lengths:* 4", 6", 8", 12", 18" and 24". Separable sockets available.

YOUR INDUSTRIAL SUPPLY DISTRIBUTOR has complete information on the 'American' Mercury-Actuated "Every Angle" Dial Thermometer. Call on him to fulfill your requirements with fast delivery from local stocks.

1850 AMERICAN U.S.A.

AMERICAN INDUSTRIAL INSTRUMENTS

MAXWELL MANNING MM&M CANADA INC. TRADE MARK

A product of **MANNING, MAXWELL & MOORE, INC.** STRATFORD, CONN.

In Canada: *Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario*

MAKERS OF 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'ASHCROFT' GAUGES, 'CONSOLIDATED' SAFETY VALVES, 'AMERICAN-MICROSEN' INDUSTRIAL ELECTRONIC INSTRUMENTS, *Stratford, Conn.* 'HANCOCK' VALVES, *Watertown, Mass.* 'CONSOLIDATED' SAFETY RELIEF VALVES, *Tulsa, Okla.* AIRCRAFT CONTROL PRODUCTS, *Danbury, Conn., and Inglewood, Calif.* "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES, *Muskegon, Mich.*

A bank of

P.E.S.A.*

*Petroleum Equipment Suppliers Association

experience for YOU

provided by P.E.S.A. *members*

PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION

Composed of: *manufacturers* whose plants make the finest precision equipment . . . ***supply stores*** who add two other ingredients of value—where you want it—when you want it . . . ***service companies*** who make available to their customers the practical results of the theoretical research of some of the most brilliant scientific and technical men in the world.

One and a half million man-years experience

. . . to give YOU most for the dollar

. . . to provide YOU with precision equipment and technical services

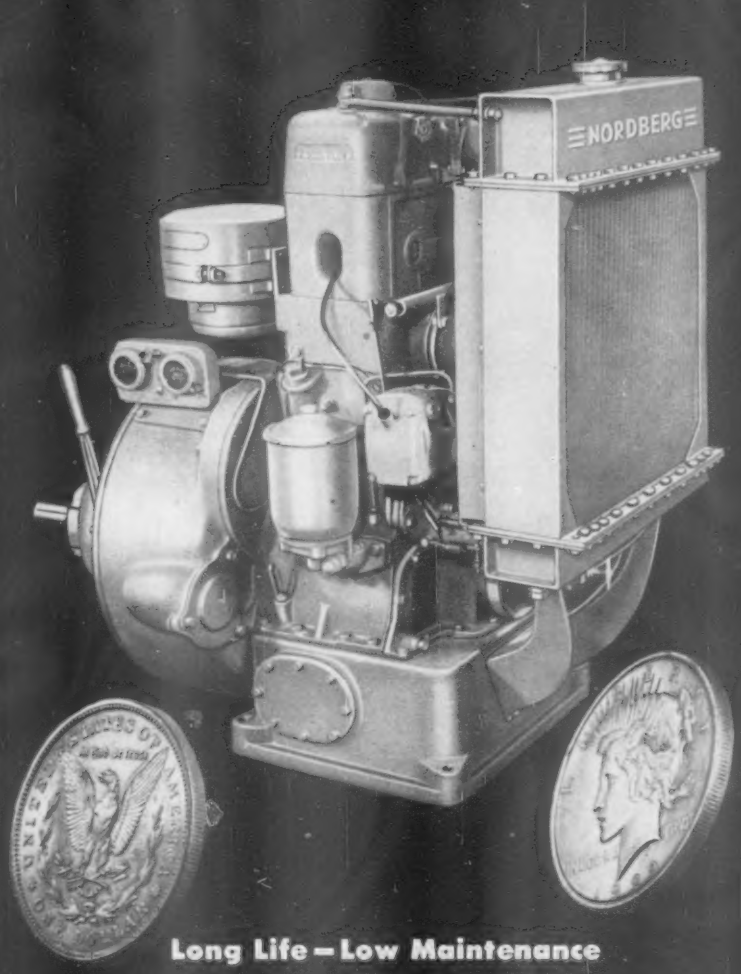
The drilling and producing industry needs this tremendous man-years experience of P. E. S. A. members to keep up with its vast requirements of precision equipment and technical services.

P. E. S. A. has the experienced industrial army of scientists, engineers, metallurgists, technicians, executives, managers, craftsmen, skilled mechanics, specialized workers of all kinds—all trained to produce the special products and specialized technical services for the oil industry.

Under the free enterprise system, each of these companies is doing its utmost to provide its customers with the most for the dollar, knowing that not to do so invites others to do better. This keeps these companies on their toes and keeps their earnings at a level commensurate with their ability to provide improved products and services.

Whatever the future requirements of the oil industry, its operators can be sure that P. E. S. A. members will be ready with new tools, equipment and methods.

MARSH
Christmas Tree
GAUGE
...it stands alone-
In this latest development we reaffirm our pledge to make a better gauge ever better. Only in the Marsh Christmas Tree Gauge you have:
—A better tube construction— bourdon tube and socket fused into a one piece permanently leak-proof unit by the exclusive Marsh "Conoweld" process.
—A better movement—all but frictionless as a result of the self-lubricating effect of unlike metals. Coined sector gear gives greater strength where greater strength is needed; also smoother operation.
—A better case—a copper-clad wrought steel case of boiler plate thickness, produced by the "Marsh-alloy" process. It has the strength of steel, the corrosion resistance of copper, and is one-third lighter than conventional cast-iron cases. The case is finished in corrosion-resistant satin black enamel.
—the Marsh "Recalibrator"—not only the handiest way to keep a gauge accurate; also the *best* way.
★ There is a Marsh Gauge for every oil country and refinery application. Ask your supply house or write for latest bulletins.
MARSH INSTRUMENT CO.
Sales affiliate of Jas. P. Marsh Corporation
DEPT. L, SKOKIE, ILL.
Houston Branch Plant: 1121 Rothwell St., Sect. 15, Houston, Texas
Marsh Instrument & Valve Co. (Can.) Ltd.
8407 103rd Street, Edmonton, Alberta, Canada
MARSH
STOCKED by Your Local Supply Store
GAUGES



DOLLAR FOR DOLLAR...

NORDBERG

POWER CHIEF®

ENGINES

are your Best Buy for Oil Field Service

Long Life – Low Maintenance

These two important factors in the long run justify the soundness of your original investment in oil field pumping engines.

Before you buy your next engine consider the many service histories of Nordberg *Power Chief* engines that show over 30,000 hours of continuous pumping operation, with the original rings, pistons, liners, bearings and crankshaft still in place . . . this is real proof of value received for dollar invested.

Add to this the many "extras" such as enclosed clutch power take off and safety shut down control that are included as standard equipment on *Power Chief* engines and you will see why you save by specifying *NORDBERG*.

NORDBERG MFG. CO., MILWAUKEE, WIS.

CONDENSED SPECIFICATIONS

	ONE CYLINDER	TWO CYLINDER
Bore & Stroke	4½" x 5¼"	4½" x 5¼"
Piston Displ.	83.5 cu. in.	167 cu. in.
Compression Ratio	6 to 1	6 to 1
Speed Range	800 to 1800 rpm	800 to 1800 rpm
Horsepower	18 hp, max.	36 hp, max.

© 1957, Nordberg Mfg. Co.

AVAILABLE AT YOUR LOCAL SUPPLY STORE — OR CONTACT THESE AUTHORIZED DISTRIBUTORS:

NORDBERG

POWER CHIEF DIESEL and GAS ENGINES

4-357-0

FRED E. COOPER, INC., Tulsa, Oklahoma
BRANCHES: Houston, Odessa, Olney
SALES & SERVICE: Casper, Wyo.; Corpus Christi, Longview & Wichita Falls, Texas; Lafayette, La.; Wichita, Kansas.

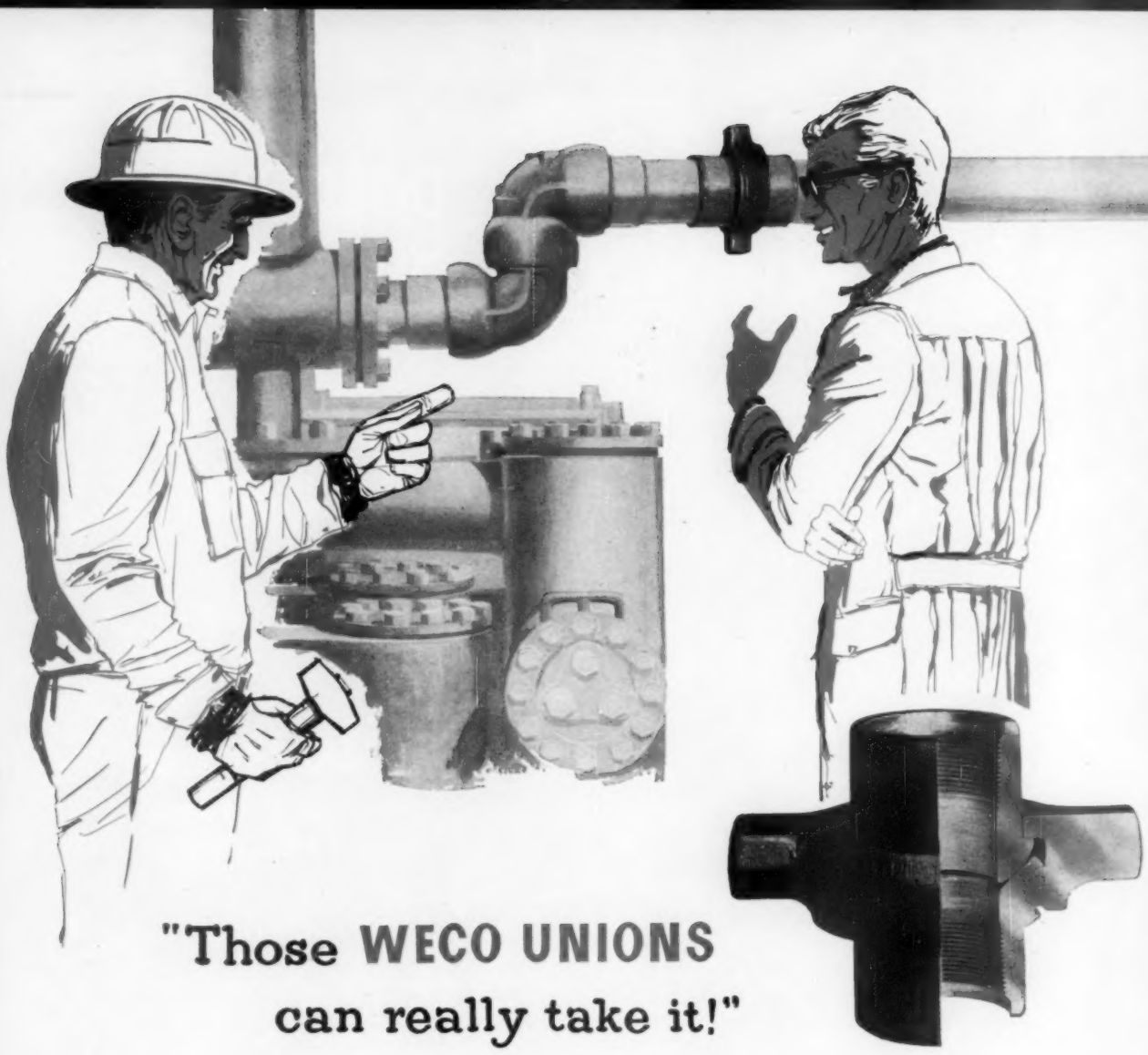
IN-MAR CO., Wilmington, California

STEPHENS OIL FIELD REPAIR, Fairfield, Illinois

MEAD ENGINE & WELDING WORKS, Sterling, Kansas

CORNELISON ENGINE MAINTENANCE CO., INC., Seminole, Oklahoma

ROGERS DIESEL ENGINEERING CO., New Orleans, La.



"Those WECO UNIONS can really take it!"

Watch a rig worker make-up or break-out a Weco and you will be convinced that here is a union that never needs pampering. For Weco Unions are built with extra strength to take the extraordinary service required in drilling an oil well.

But that's only half of the story. Even after repeated make-up on location after location, Weco's ball and cone seat maintains a perfect, leak-proof seal.

This ability to successfully take the toughest treatment results in better, longer union service at less cost . . . best reasons in the world to insist on Weco Unions . . . available at supply stores everywhere.

U-6-56

WECO®

WELL EQUIPMENT MFG. CORP.
HOUSTON, TEXAS

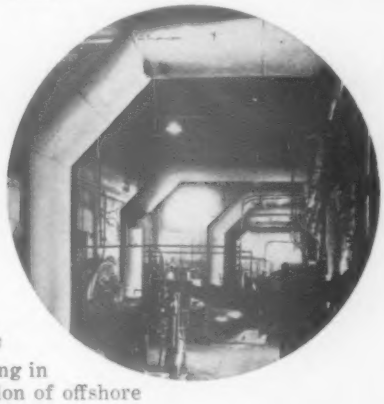
Division of CHIKSAN COMPANY *a subsidiary of*
FOOD MACHINERY AND CHEMICAL CORPORATION

PESA

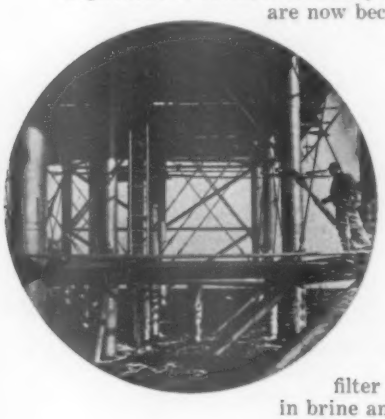
fmc
FOOD MACHINERY AND CHEMICAL CORPORATION

How Monel pays off in equipment exposed to salt solutions

. . . pays off in pumps At Caloil's Perth Amboy refinery, this pump supplies 40,000 GPM of brackish cooling water. To counter the severe corrosive and erosive conditions, its shaft sleeves and 2200-lb. impeller are Monel* nickel-copper alloy. Monel alloy is a money-saver in seawater pumps.

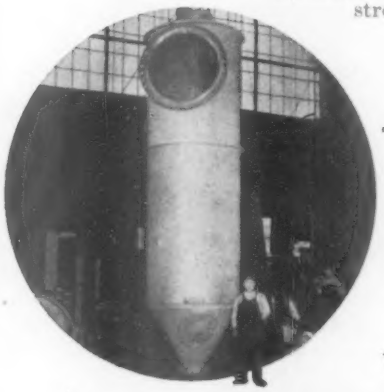


pays off in piping . . . In this California refinery, lightweight Monel lines proved able to handle salt water years longer than cast iron. This experience has been duplicated so often, Monel alloy piping, fittings, and valves are now becoming standard for such service.



. . . pays off in structurals The value of Monel alloy sheathing in preventing splash-zone corrosion of offshore structures like this is well-known. A less spectacular but equally valuable use is for plant structurals subject to salt splash, spill or atmospheres . . . tank supports, for example, or just plain nuts and bolts.

pays off in process vessels . . . These Sharples Super-D-Hydrators filter sodium sulfate crystals, wash them in brine and then dry them. Monel alloy provides just the needed properties for parts . . . . top-notch resistance to both corrosives, strength to handle high centrifugal forces, excellent fabricability.



. . . pays off in heat exchangers, condensers This barometric condenser is now in service at a large eastern sugar refinery. It features a Monel Clad Steel shell and solid Monel alloy internals. This construction has proved so effective in resisting the corrosive attack of brackish bay water that the refinery has standardized on Monel.

If your equipment for handling seawater and salt solutions is deteriorating faster than it should, an evaluation of Monel alloy in the application may prove helpful. Write Inco's Development and Research Division. *Registered trademark

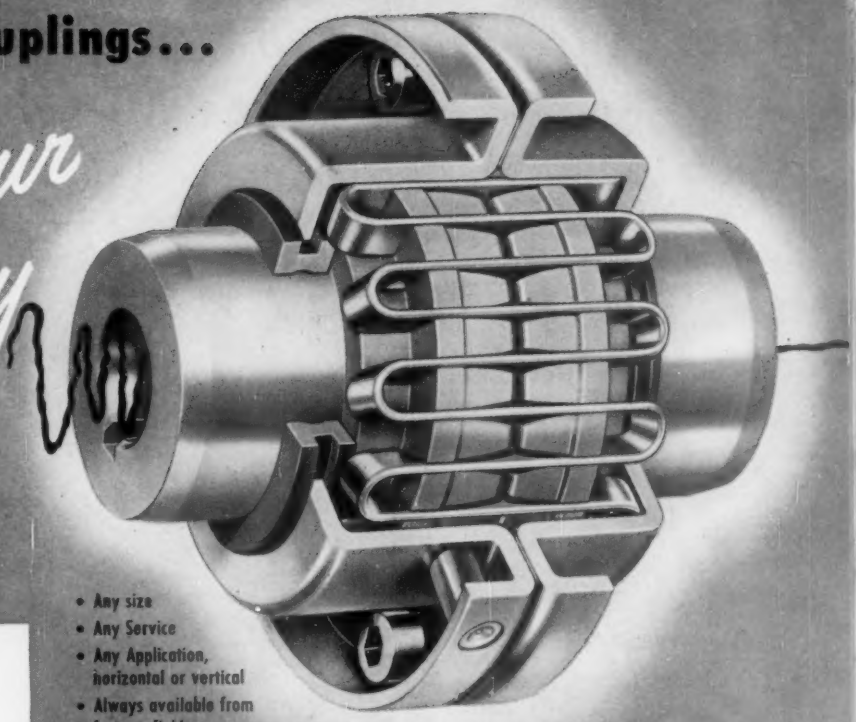
THE INTERNATIONAL NICKEL COMPANY, INC., 67 Wall Street, New York 5, N.Y.

INCO TRADE MARK Nickel Alloys

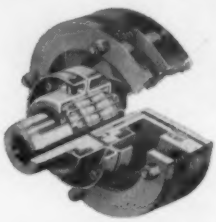
Monel ***. . . for minimum maintenance***

Falk Steelflex Couplings...

Protect your machinery in 2 ways



- Any size
- Any Service
- Any Application, horizontal or vertical
- Always available from factory, field or distributor stocks

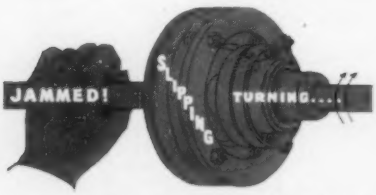


Falk Controlled Torque Couplings prevent damage from overloads

In applications where danger from overloads exists, use the FALK Type FT Controlled Torque Coupling. The Type FT has all the features and advantages of standard FALK Steelflex couplings—and, in addition, has an adjustable friction slip clutch, enabling the operator to set the coupling to slip at any predetermined overload.

This controlled-torque principle not only prevents transmission of dangerous shocks and limits overloads; it eliminates the breaking of shafts caused by jamming of driven equipment.

An outstanding advantage of the Type FT Coupling is that, as soon as the cause of the overload is removed, the entire coupling will rotate and transmit power without replacing parts or repairing coupling.



There's real economy in using Type FT Controlled Torque Couplings. Many users have reported that these couplings paid for themselves the very first time they slipped (under overload) because of the protection against damaged driving or driven machinery!

...cost less per year of service!

You get *double protection* when you connect your driving and driven machinery with a Falk Steelflex Coupling—the all-steel coupling with the exclusive grid-groove design! First, its *torsional resilience* smothers shock and vibration; and second, the Steelflex design prevents damage and lowered efficiency by accommodating shaft misalignment.

Why have increasing numbers of key men in industry standardized on Falk Steelflex Couplings? Their experience has proved that Falk Steelflex Couplings prolong the service life of their machinery... are trouble-free and need minimum maintenance... are easy to install, lubricate and disconnect... and *cost less per year of service* than ordinary couplings.

One basic Steelflex design—the type F, in its many sizes—is adaptable to more than 90% of all industrial applications. For applications involving danger from overloads, Modified Type FT Controlled Torque couplings (see column at left) are ideally suited. There are numerous other special or dual purpose Steelflex couplings for unusual applications. **Write to Department 247** for engineering bulletin, including selection and dimension tables.

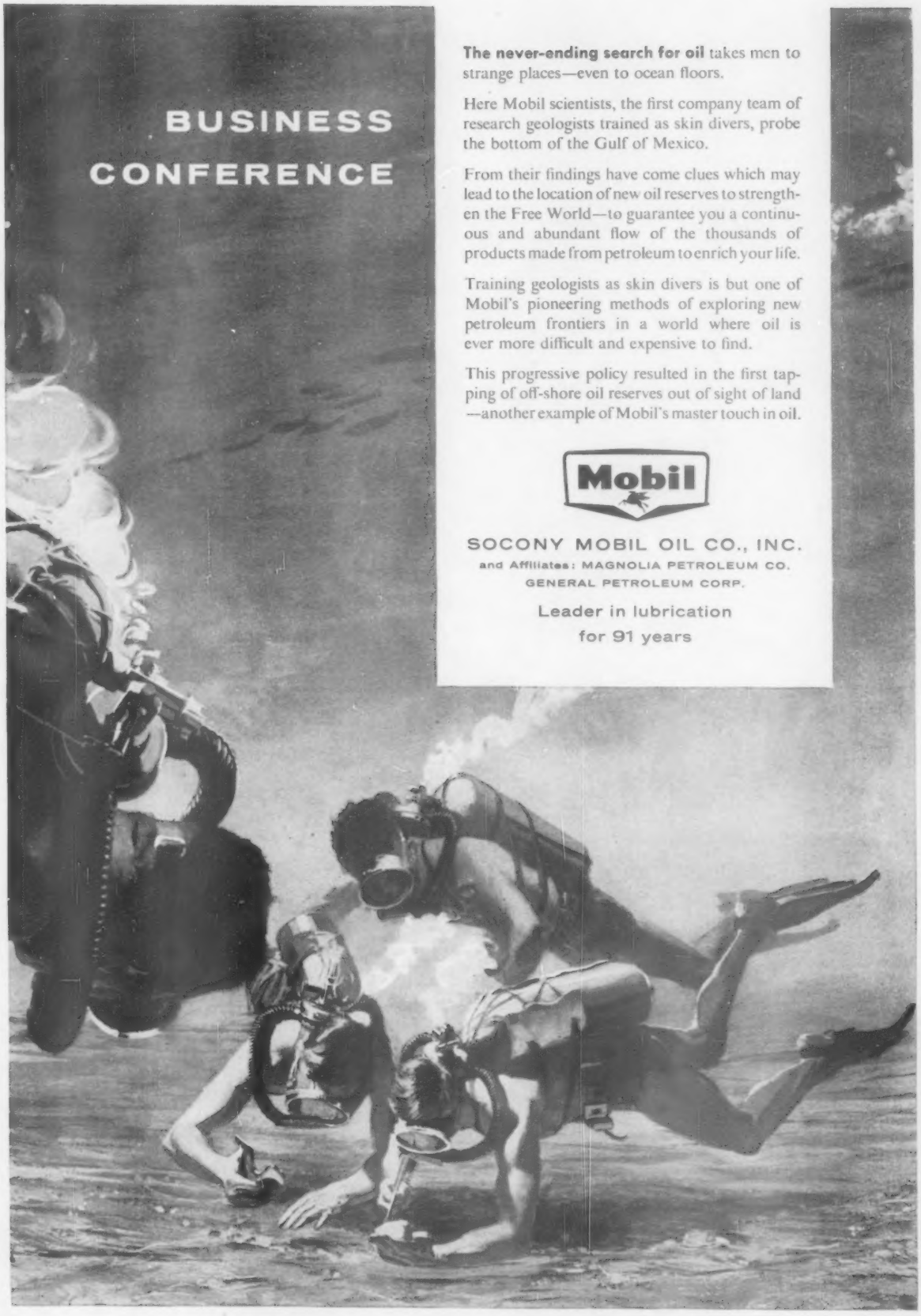
THE FALK CORPORATION, MILWAUKEE, WISCONSIN

FALK

...a good name in industry

MANUFACTURERS OF:

- Motoreducers
- Speed Reducers
- Flexible Couplings
- Shaft Mounted Drives
- High Speed Drives
- Special Gear Drives
- Single Helical Gears
- Herringbone Gears
- Marine Drives
- Steel Castings
- Weldments
- Contract Machining



The never-ending search for oil takes men to strange places—even to ocean floors.

Here Mobil scientists, the first company team of research geologists trained as skin divers, probe the bottom of the Gulf of Mexico.

From their findings have come clues which may lead to the location of new oil reserves to strengthen the Free World—to guarantee you a continuous and abundant flow of the thousands of products made from petroleum to enrich your life.

Training geologists as skin divers is but one of Mobil's pioneering methods of exploring new petroleum frontiers in a world where oil is ever more difficult and expensive to find.

This progressive policy resulted in the first tapping of off-shore oil reserves out of sight of land —another example of Mobil's master touch in oil.

Mobil

SOCONY MOBIL OIL CO., INC.
and Affiliates: MAGNOLIA PETROLEUM CO.
GENERAL PETROLEUM CORP.

Leader in lubrication
for 91 years

BUCYRUS ERIE HYDROCRANE

Here the new H-5 unloads pipe from truck. Ten-ton capacity as a crane, ½-yd. as an excavator, yet it mounts on a *conventional truck*, new or used, without sacrificing work capacity. You can choose the truck that fits your needs best.

Two fast-traveling, smooth-working Hydrocranes to speed refinery jobs

Choose the Hydrocrane that's best for your jobs. Bucyrus-Erie now offers this multi-job, all-hydraulic truck-crane in *two* popular sizes. First there's the 5-ton, ⅜-yd. H-3 — a long-standing favorite among users on a wide variety of erecting and digging jobs . . . available with 18- to 26-ft. standard telescoping boom or 30- to 38-ft. erector's boom.

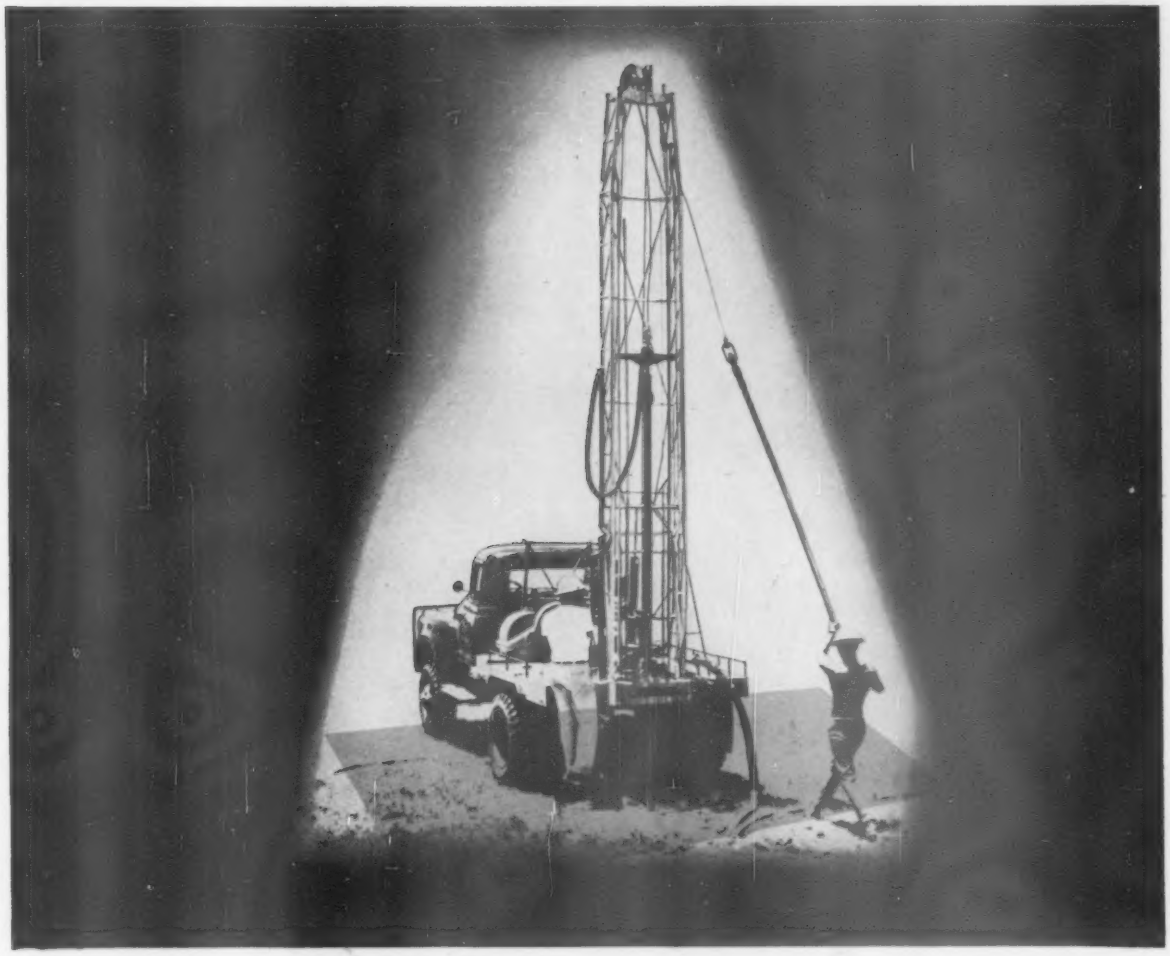
And now Bucyrus-Erie brings you the new higher-reaching, bigger-digging, 10-ton, ½-yd. H-5 Hydrocrane. Standard boom telescopes hydraulically from 24 to 36 feet, high-lift boom from 38 to 50 feet — and can be retracted to 25 feet for travel. Both models bring you all the operating advantages of full hydraulic operation and control of all work functions, 45- to 50-mph top travel speed, exceptional ability for working and maneuvering in close quarters.

For some users the Model H-3 is still the best buy; for others the greater capacity and long boom reach of the H-5 will open the way to bigger savings on more jobs. Your Bucyrus-Erie distributor can help you choose the right one for your specific needs. See him now for full details.

157H56-a

BUCYRUS-ERIE COMPANY

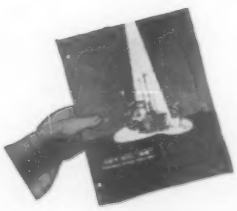
SOUTH MILWAUKEE, WISCONSIN



THE *Joy 35* SHOT HOLE RIG . . . MOVING FAST

A shot hole rig has to get around . . . has to get in . . . get the hole down . . . and get out. That's the Joy "35". It's lightweight—extremely portable . . . mounted on a short wheelbase truck, it gets in anywhere. It gets hole down fast because it's the only rig of its size that has four speeds forward . . . gives you just the right speed for the formation being drilled to get the fastest penetration. And the Joy "35" stays on the job. The entire machine is built as a group of unit assemblies . . . each of which can be replaced or exchanged independently.

Find out more about the rig that is moving fast—the Joy "35" . . . write ***Joy Manufacturing Company, Oil Field Drill Division, P.O. Box 35326, Airlawn Station, Dallas 35, Texas.*** In Canada: *Joy Manufacturing Company (Canada) Limited, Galt, Ontario.*



Get complete details on the 35-C. Write for bulletin 152-31.

WSW 06467-152

JOY . . . EQUIPMENT FOR OIL FIELDS

27 SALES & SERVICE LOCATIONS

Denver, Colo.; Salt Lake City, Utah; San Francisco and Los Angeles, Calif.; El Paso, Texas; Carlsbad, N.M.

Baash-Ross Tool Co. Div.—Abilene, Corpus Christi, Houston and Odessa, Texas; Harvey, New Iberia and Shreveport, La.; Ardmore and Oklahoma City, Okla.; Avenal, Bakersfield, Long Beach, Newhall, Taft, and Ventura, Calif.; Casper, Wyo.; Hobbs and Farmington, N.M.; Olney, Illinois.

Export Sales—Joy Manufacturing Company, 60 E. 56th St., New York, N. Y.

When Mathieson DIETHLYENE GLYCOL is there

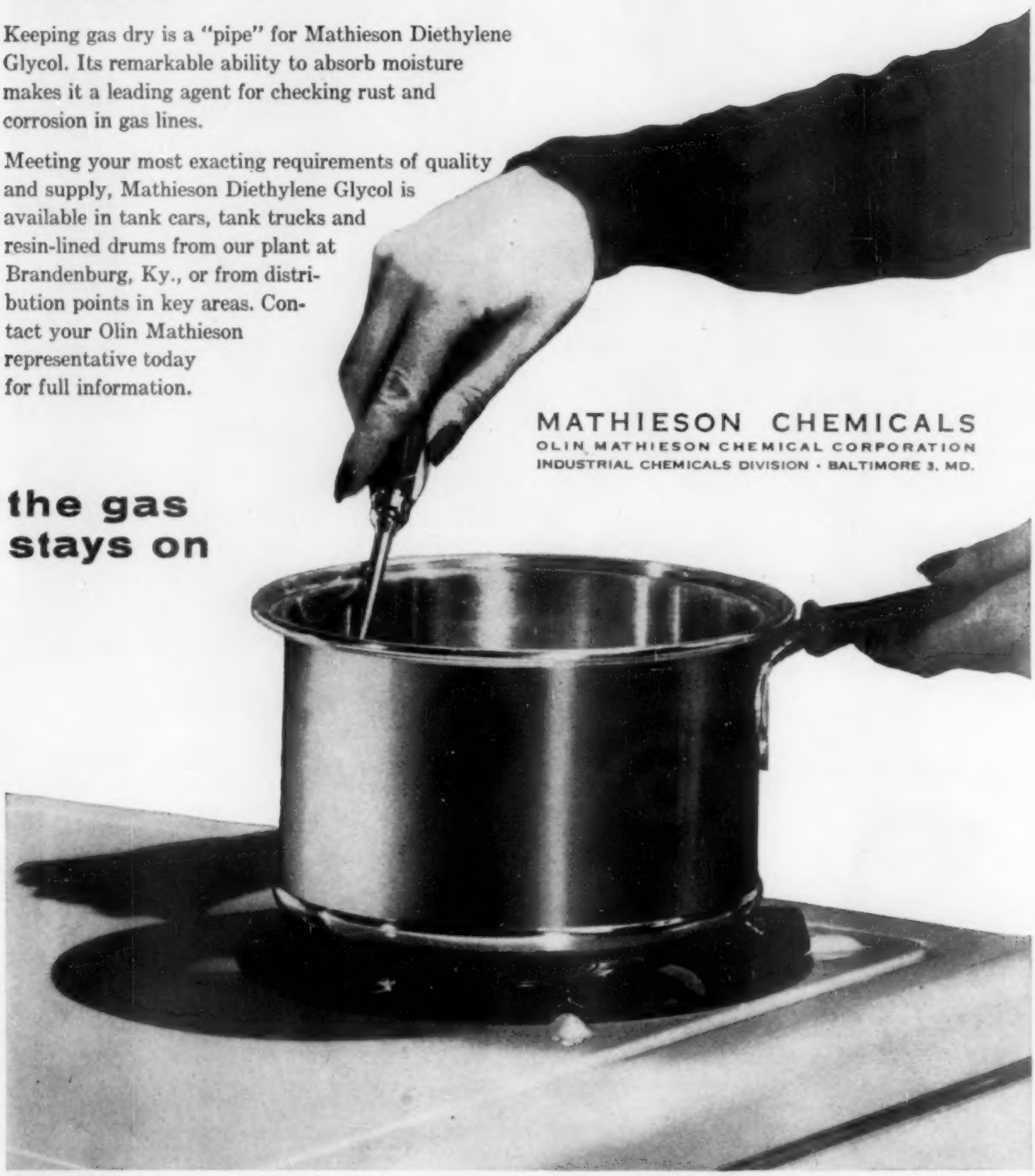
CHEMICAL PROGRESS WEEK APRIL 8-12

Keeping gas dry is a "pipe" for Mathieson Diethylene Glycol. Its remarkable ability to absorb moisture makes it a leading agent for checking rust and corrosion in gas lines.

Meeting your most exacting requirements of quality and supply, Mathieson Diethylene Glycol is available in tank cars, tank trucks and resin-lined drums from our plant at Brandenburg, Ky., or from distribution points in key areas. Contact your Olin Mathieson representative today for full information.

MATHIESON CHEMICALS
OLIN MATHIESON CHEMICAL CORPORATION
INDUSTRIAL CHEMICALS DIVISION · BALTIMORE 3, MD.

the gas stays on

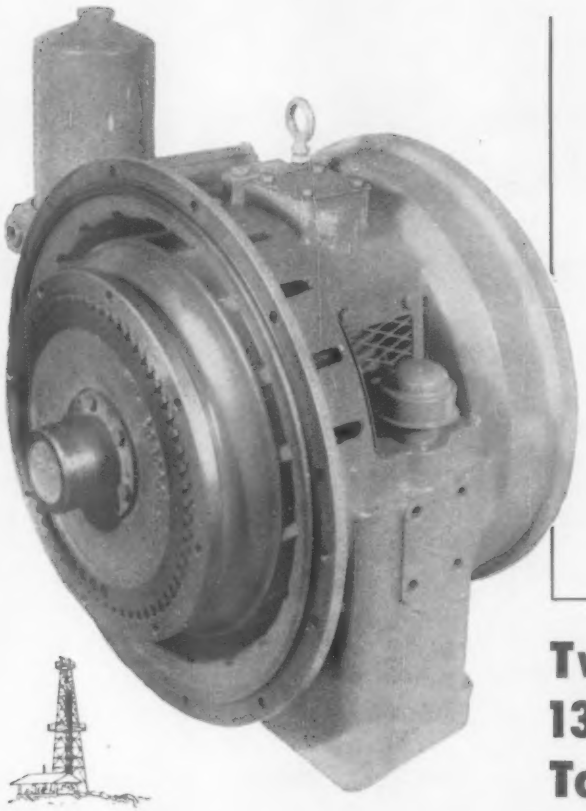


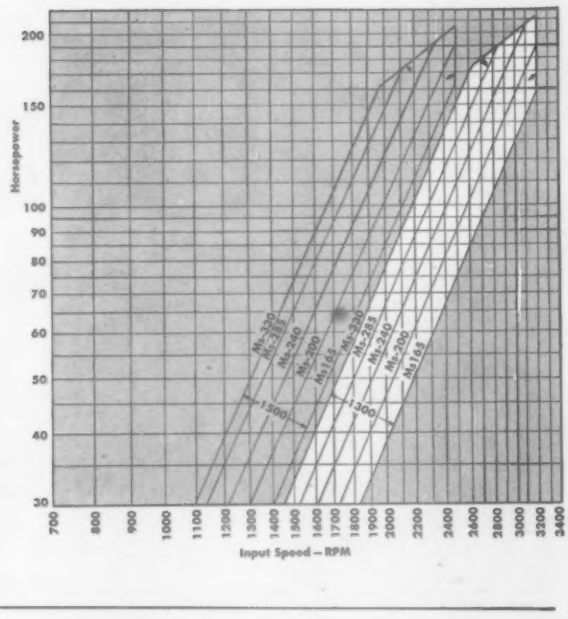
MATHIESON

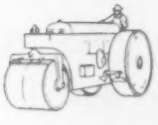
INORGANICS: Ammonia · Bicarbonate of Soda · Carbon Dioxide · Caustic Potash · Caustic Soda · Chlorine · Hydrazine and Derivatives · Hypochlorite Products · Muriatic Acid · Nitrate of Soda · Nitric Acid · Soda Ash · Sodium Chlorite Products · Sulfate of Alumina · Sulfur (Processed) · Sulfuric Acid

ORGANICS: Ethylene Oxide · Ethylene Glycols · Polyethylene Glycols · Glycol Ether Solvents · Ethylene Dichloride · Dichloroethylether · Formaldehyde · Methanol Sodium Methylate · Hexamine · Ethylene Diamine · Polyamines · Ethanolamines · Trichlorophenol · Surfactants

4895







TWIN DISC
CLUTCHES AND HYDRAULIC DRIVES

TWIN DISC
Torque Converters

Twin Disc offers new 1300 Series Single-Stage Torque Converters

To meet the growing trend toward higher speed diesel and gasoline engines, Twin Disc Clutch Company announces its new 1300 Series Single-Stage Torque Converters . . . a series that offers ideal torque ratings for shovels, materials handling equipment, small industrial locomotives, front-end loaders, hoisting machinery, road rollers, graders and many similar applications.

The new 1300 Series Single-Stage Torque Converters are rated from 30 hp at 1450 rpm to 212 hp at 3200 rpm . . . with impellers available for specific torque ratings of 165, 200, 240, 285 and 330 pound-feet.

Current production of the 1300 Series consists of one model—the Model "F." This is a spacer-type arrangement with an SAE No. 2 flywheel housing size and either an SAE No. 2 or No. 3 output housing.

Like the Twin Disc 1500 Series Single-Stage units, the 1300 Series has an exclusive blade design which develops a counter-head at high-speed ratios, stopping fluid circulation. This simplifies design and construction and eliminates the need for a free-wheeled stator.

Impellers having different bladings (both number of blades and pitch) are interchangeable, permitting torque capacities to be matched more accurately to engines of various hp sizes and speeds.

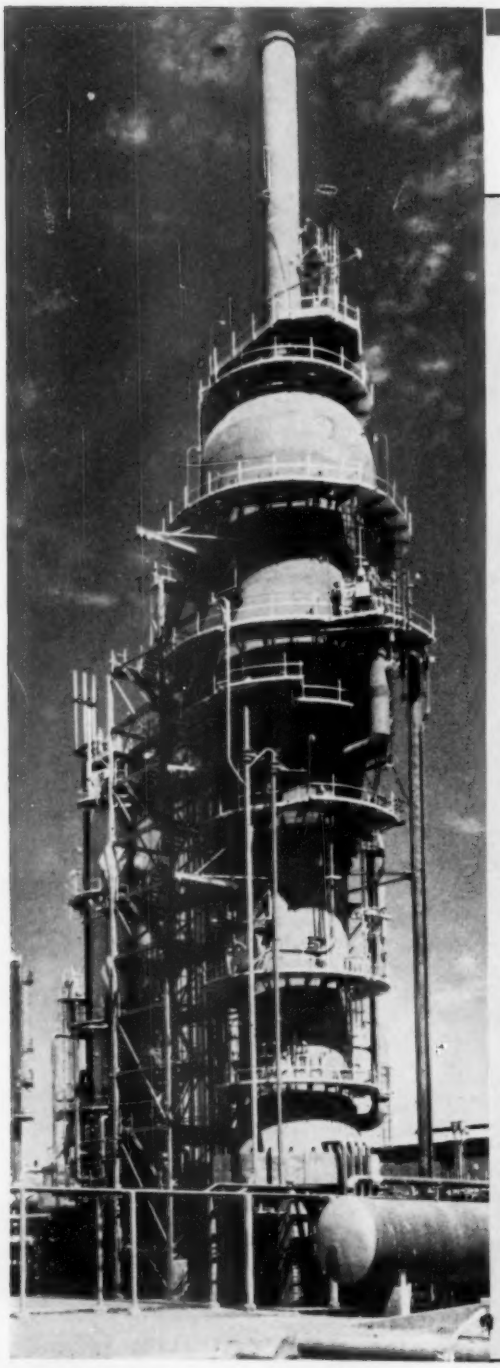
The 1300 Series cooling requirements are minimized because of a rotating impeller housing which provides air circulation through the ventilated stationary housing.

If you've been considering a torque converter in your machinery designs, or are dissatisfied with your current single-stage units, investigate today the benefits offered by the new Twin Disc Single-Stage Torque Converters. Write for Bulletin 508 Supplement.

TWIN DISC CLUTCH COMPANY, Racine, Wisconsin • HYDRAULIC DIVISION, Rockford, Illinois

Branches or Sales Engineering Offices: Cleveland • Dallas • Detroit • Los Angeles • Newark • New Orleans • Tulsa

Orthoflow®



ORTHOFLOW FLUID CATALYTIC CRACKING UNITS BY THE M. W. KELLOGG COMPANY

DATE ON STREAM	LOCATION	DESIGN CAPACITY Total Throughput, BPD
1951	Edmonton, Alberta	3,500
1951	Ponca City, Okla.	10,939
1952	Sarnia, Ontario	14,027
1953	Gelsenkirchen, Germany*	5,000
1953	Toledo, Ohio	17,705
1954	Smiths Bluff, Texas	26,625
1954	Clarkson, Ontario	17,415
1954	Philadelphia, Pa.	45,000
1955	Amarillo, Texas	9,706
1955	Kwinana, Australia	12,500
1955	St. Boniface, Manitoba	8,374
1955	Enid, Okla.	13,500
1956	Delaware City, Del.*	101,800
1956	Yorktown, Va.	30,618
1956	Puerto La Cruz, Venezuela	14,290
Future	Mataripe, Brazil	20,493

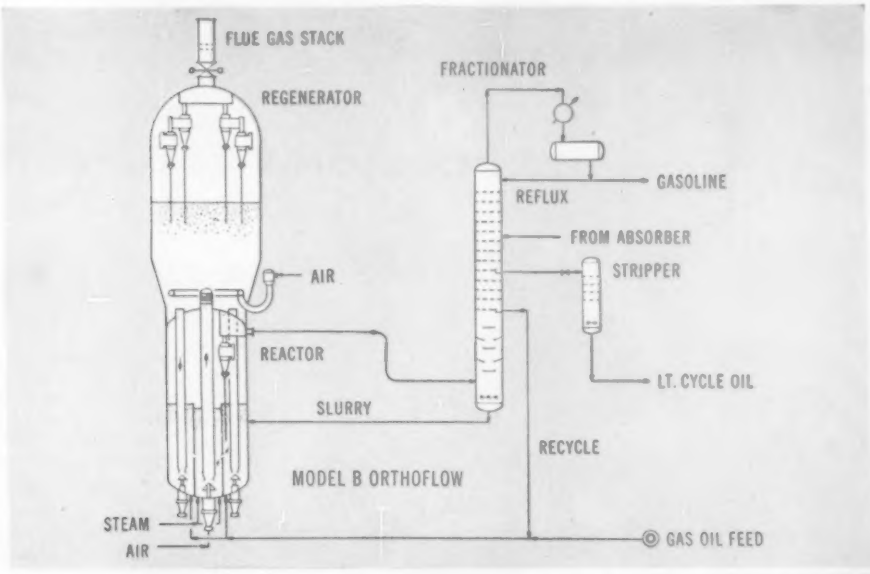
® *Trademark of The M. W. Kellogg Company*

**Process and Engineering only*

is on the go

Low initial investment, low direct operating expense, and low maintenance costs have brought world-wide recognition in a few short years to the Orthoflow Fluid Catalytic Cracking Unit—a development of Kellogg's many years' experience in engineering and erecting fluid cat crackers of other types.

For refiners contemplating expansion with the earliest possible on-stream date, Kellogg engineers will be glad to interpret the economics and efficiency of the Orthoflow vertical design in terms of individual refinery conditions and requirements.



Refinery Process Division

The M. W. Kellogg Company

711 Third Avenue, New York 17, N. Y.

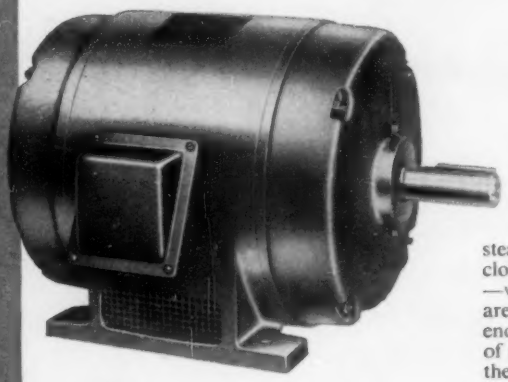
A SUBSIDIARY OF PULLMAN INCORPORATED

The Canadian Kellogg Company Ltd., Toronto · Kellogg International Corp., London · Kellogg Pan American Corp., New York · Societe Kellogg, Paris · Companhia Kellogg Brasileira, Rio de Janeiro · Compania Kellogg de Venezuela, Caracas

Wagner®
ELECTRIC MOTORS
...the choice of leaders in industry

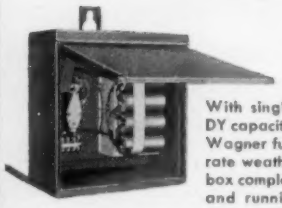
there's a Wagner Motor for every job

...in the oil fields



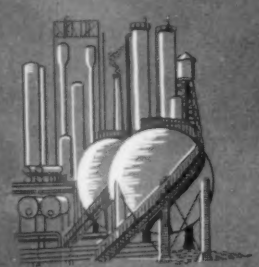
OIL WELL PUMPING MOTORS

Wagner cast-iron frame oil well pumping motors, either polyphase or single-phase, are especially designed for rugged, steady, outdoor service. The enclosures are completely drip-proof —virtually splash-proof. Air intakes are located at the bottom of the endplates to admit a cooling flow of air to the motor, while retarding the entrance of water. Outlets are located at the base of the frame, one on each side. Screened openings keep reptiles or small animals from entering the motor. The conduit box is moisture-proof and dust tight. For locations where only single-phase current is available, Wagner can furnish high power factor type capacitor-start motors with the same enclosures. You can get Wagner Oil Well pumping motors *from stock* in your immediate area.

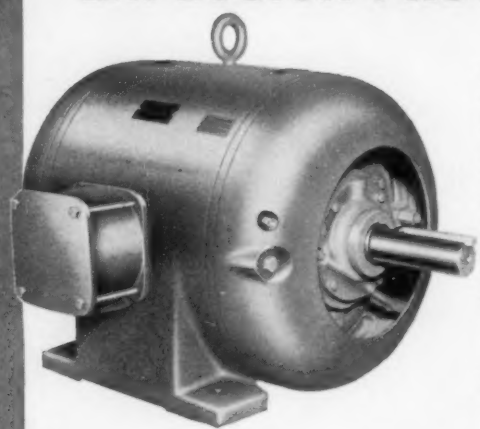


With single-phase Type DY capacitor start Motors, Wagner furnishes a separate weatherproof control box complete with starting and running capacitors and voltage relay.

...in the refinery



EXPLOSION-PROOF MOTORS



These powerful Type JP polyphase motors are expressly built for applications in explosive atmospheres. They are approved for Class I Group D hazardous locations. Totally-enclosed fan-cooled construction, with frames and endplates of cast iron, makes them suitable for indoor or outdoor use and for installations where corrosion is a problem. Available in ratings through 250 hp.

For full information, write for Bulletins MU-132 and MU-137. Thirty-two branch offices are ready to assist you in any motor application problem.

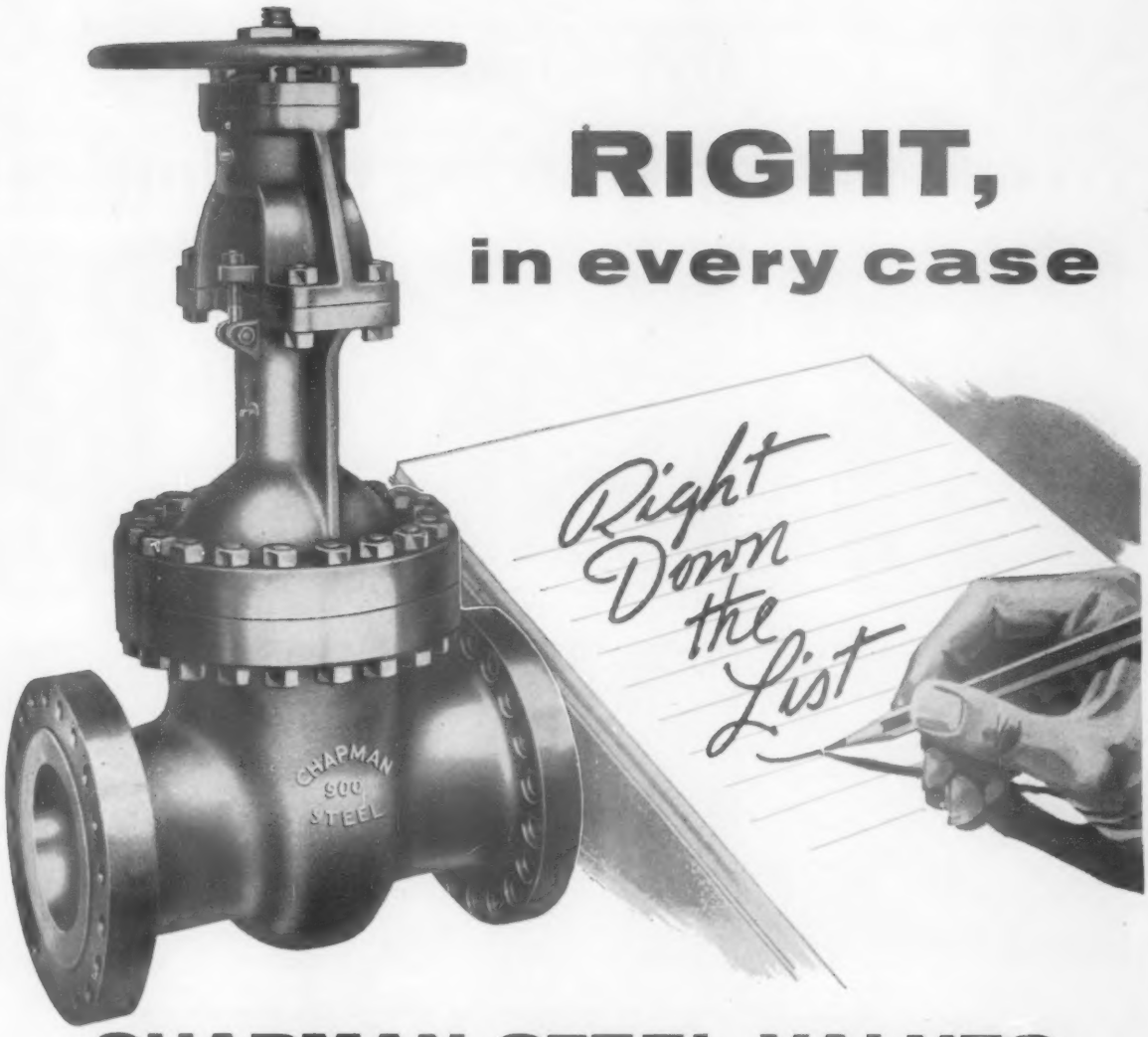
Wagner Electric Corporation
EST. 1891

M56-13

Wagner Electric Corporation
6389 Plymouth Ave., St. Louis 14, Mo., U.S.A.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES • AUTOMOTIVE BRAKE SYSTEMS–AIR AND HYDRAULIC



RIGHT, in every case

CHAPMAN STEEL VALVES

Check them off, one by one. They're all important to you, a user of valves . . . steel valves. You want close tolerances; tight and positive seats; smooth, dependable, operation without jamming, chattering or excessive wear. Even with long service under the most severe conditions you want to cut your maintenance costs to a new rock bottom low.

Name your metal. You can have Chapman Steel Valves in standard alloys for normal requirements . . . or special alloys for extra service conditions. And for *your* benefit, all of these alloys are poured in Chapman's own foundries under rigid technical supervision.

Chapman superior steel valves — gates, globes, checks — are available for all pressure and temperature ranges. You can order them with bolted, welded or pressure seal body and bonnet joints and with flanged or welding ends. They all equal or exceed ASA and API standards in every range.

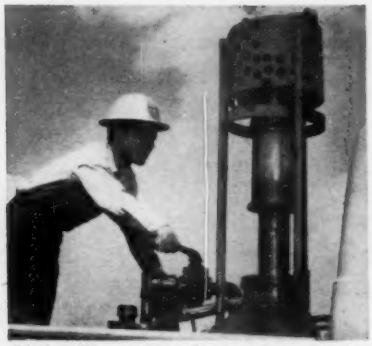
Why not write now for our complete descriptive catalog No. 20.

THE CHAPMAN VALVE MANUFACTURING CO.
INDIAN ORCHARD, MASS.

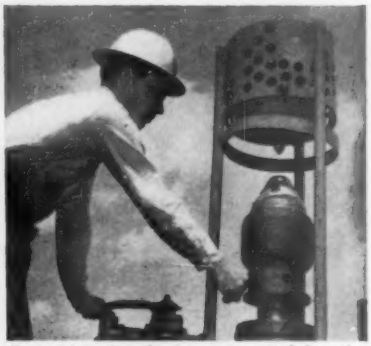
US RUBBER Pipe Protectors

...are put on a string in minutes!

Operator is putting protector on the cone for expansion over the sleeve.



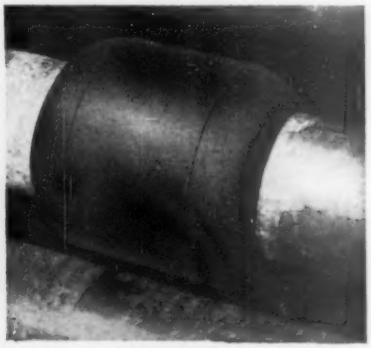
Hydraulic pressure forces the protector from the cone onto the sleeve.



Removing the sleeve now containing the expanded protector.

Slipping the sleeve and the protector over the pipe collar.

Protector is "kicked off" sleeve onto pipe. Note light delivery truck where second man is preparing another protector.



Sleeve quickly slips off and the protector fits tight to the drill pipe.

U. S. Pipe Protectors are the *best* protection for drill pipe and casing

- stop tool joint wear and prevent injury to casing
- lower vibration, reduce friction and torque
- simplify deep and crooked well drilling
- reduce twist-offs, "soft pipe" troubles and line "whip"
- unharmed by oils, acids, or high gas pressures
- can be used in any kind of mud
- can be successfully removed and re-applied... after use in oil-base muds
- anti-swirl end design prevents "pipe-ringing"
- solidly molded of a special neoprene compound
- made to fit every size drill pipe and casing condition

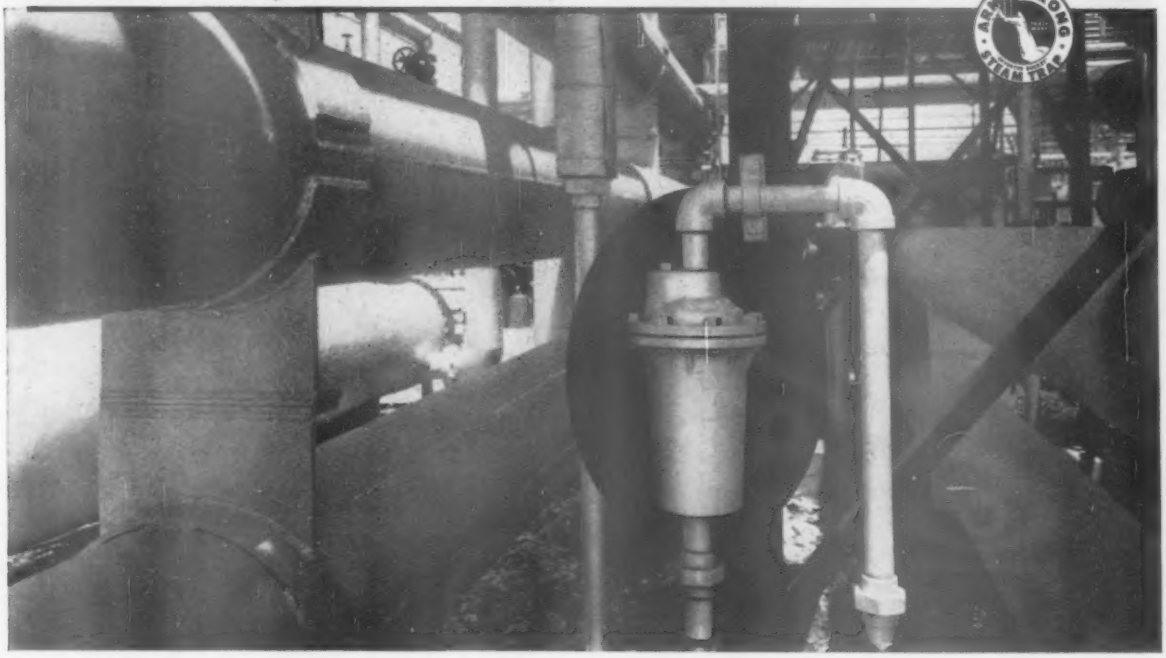
Ask for them through your supply house or authorized U. S. Rubber Pipe Protector Distributor. You'll get instant applicator service.

Coming Soon—New *Blue* Pipe Protectors for extra high pressures encountered below 18,000 feet.

US RUBBER Mechanical Goods Division

United States Rubber

BILLIONS OF BARRELS OF THROUGHPUT DEPEND ON ARMSTRONG STEAM TRAPS. THEIR OUTSTANDING RECORD FOR DEPENDABILITY AND LOW MAINTENANCE HAVE MADE THEM NO. 1 IN THE PETROLEUM INDUSTRY, WHERE THE BEST IS NONE TOO GOOD. TRAPS REPESENT A VERY SMALL FRACTION OF 1. PERCENT OF REFINERY CAPITAL INVESTMENT, YET VITALLY AFFECT EFFICIENCY AND MAINTENANCE COSTS. THIS IS NO PLACE TO PINCH PENNIES OR COMPROMISE ON QUALITY. CALL YOUR LOCAL ARMSTRONG REPRESENTATIVE... ASK FOR CATALOG J... OR WRITE ARMSTRONG MACHINE WORKS, 8684 MAPLE STREET, THREE RIVERS, MICHIGAN.



FAST REPLACEMENT

When a refinery has to shut down for a replacement or repair—that's the time when action and know-how count.

The special spiral fin unit here shown had to be built over a week-end to get a large oil refining plant back on stream.

Such repair and replacement work has added to the fine reputation Sun Ship has won through years of service in the construction of oil refining and chemical equipment of every kind.

Sun

SHIPBUILDING & DRY DOCK COMPANY

ON THE DELAWARE SINCE 1916 CHESTER, PA.

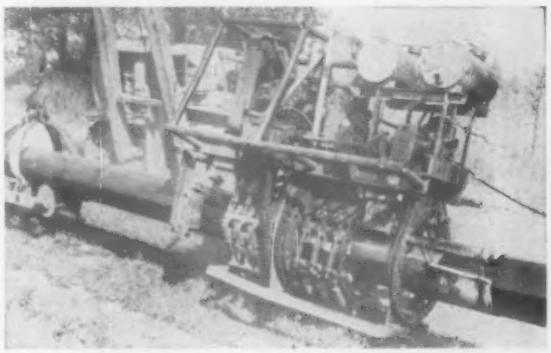
(Left) NO-OX-ID and NO-OX-IDized Wrapper application by Traveliner. (Right) NO-OX-ID kettle.

3-PIECE OUTFIT FOR WELL-DRESSED PIPE

This carrier pipe is being well dressed for years of uninterrupted service underground. A 3-piece outfit—cleaning machine, dope kettle and Traveliner—does the job.

The dressing? NO-OX-ID Coating and NO-OX-IDized Wrapper—a combination that provides chemical-mechanical protection against corrosion and destructive soil action. NO-OX-ID is applied hot or cold by hand or machine...over the ditch or at the mill. No noxious fumes. You save on material because less NO-OX-ID coats more pipe per day. NO-OX-ID Coating and Wrapper combinations shield against corrosion attack.

On your next transmission or distribution line coating job, consult with your Dearborn Pipeline Engineer. Ask him to recommend the NO-OX-ID combination best suited to your requirements. Cost is reasonable and the protection long lasting. The best dressed pipe is NO-OX-ID PROTECTED!



Cleaning and priming prior to coating.

Mail coupon for factual information on NO-OX-ID Coatings and NO-OX-IDized Wrappers

Dearborn NO-OX-ID®

Specify NO-OX-ID combinations for long-term protection

Dearborn Chemical Company
Dept. OG, Merchandise Mart Plaza
Chicago 54, Illinois

☐ Send me NO-OX-ID Coating Combinations literature
☐ Have a Dearborn Pipeline Engineer Call

Name.....*Title*.....

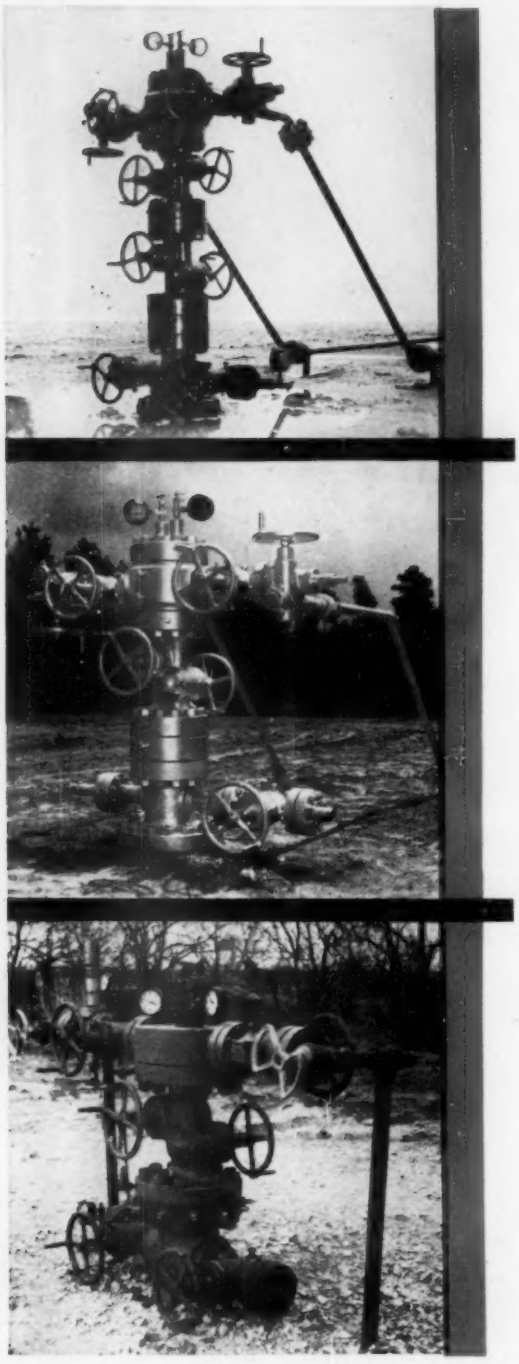
Company.....

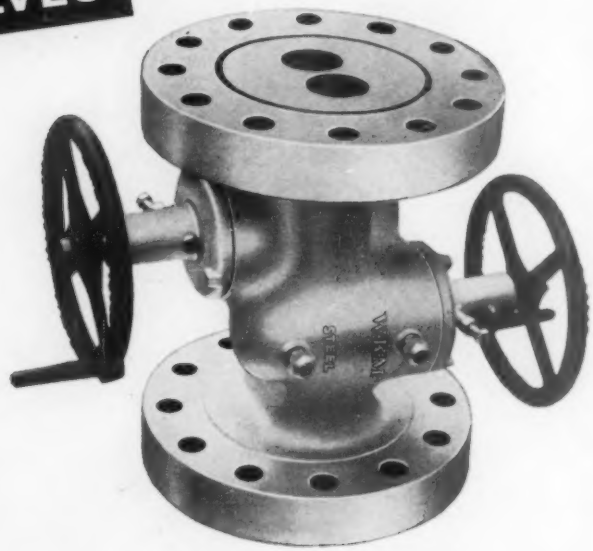
Address.....

City.....*Zone*.....*State*.....

The best Dual Completion Trees use

W-K-M DUAL VALVES





For your next dual completion tree, specify W-K-M Dual Valves. They are available in 2″ and 2½″ sizes; working pressures from 2000 to 10,000 psi. The conduits are spaced to permit running two 2″ tubing strings in 7″ or 7⅝″ casing; two 2½″ tubing strings in 8⅝″ casing.

Your W-K-M Dual Valve tree will be more compact and give you better control of your well. You have two W-K-M Valves in one body. Both have all these time-and-service proved advantages of W-K-M Valves: through-conduit for smooth non-turbulent flow; parallel expanding gate for positive metal-to-metal seal at each seat and for easy opening and closing; pressure seal bonnet that seals tighter as pressure and temperature increase.

Whether you use two Dual Valves or two plus a swabbing valve, you have a more compact tree with the valves easily accessible from ground level. Have your W-K-M Representative give you complete information about W-K-M Dual Valves.

5612

W-K-M

DIVISION OF acf INDUSTRIES INCORPORATED

Plant: Missouri City, Texas
Mailing Address: P. O. Box 2117, Houston, Texas

MANUFACTURERS OF

W-K-M	acf	KEY
THROUGH-CONDUIT	LUBRICATED	RETURN BENDS
GATE VALVES	PLUG VALVES	AND FITTINGS

They Say—

Gulf defends its imports

"Gulf has complied with all requests from the ODM regarding imports, and even before the ODM was involved in this question, Gulf had many times taken action to reduce or hold back increases in its imports when total oil imports in the U. S. appeared to be growing at an unusually rapid rate.

W. K. WHITEFORD

"The result of the above policy has been that the ratio of Gulf's imports to the total for the industry has steadily declined. Since 1947 Gulf imports have declined from 17.4 per cent of the total for the industry to an estimted 9.5 per cent for last year. This has been due not to any lack of adequate foreign crude of our own which we could have imported but solely to our own voluntary restrictions.

"As a consequence of the above and the fact that its own domestic production has not increased fast enough to supply the balance of its refinery requirements, Gulf's purchases of crude from other domestic producers have greatly increased. This year such purchases will average double what they were 10 years ago and greater than the company's entire imports."

W. K. Whiteford, president, Gulf Oil Corp., in testimony before a Senate subcommittee.

Timing of crude price hike

"The question has been raised as to why, if the crude price increase were overdue, it had not occurred before, and whether increasing the price during the Suez crisis was taking advantage of a situation. In my opinion it had not come earlier for three principal reasons — surplus productive capacity, the volume of U. S. inventories, and the rate of growth of imports.

"First, about surplus productive capacity. At the close of World War II, we had no surplus producing capacity in this country. In the postwar period, our Government had urged the oil industry to develop and maintain a reserve of crude-oil producing capacity in this country for national security reasons. The industry . . . developed such a reserve capacity, which at the time the emergency occurred amounted to some 1,500,000 to 2,000,00 bbl. per day, or from 20 to 25 per cent of the current production rate.

". . . The Suez emergency quickly demonstrated that . . . the actual surplus producing capacity quickly available to the U. S. Gulf was far less than the figures mentioned above.

"As to inventories . . . both crude and product stocks had been considered on the high side, but by the end of December all stocks, except gasoline, available for export shipment had been materially reduced and the trends were still downward. . . .

"Finally, the rate of growth of imports of crude oil—particularly with respect to Middle East crude—which had been felt by many to be increasing too fast, was sharply curtailed. The rapid easing of all these deterring factors coupled with the long term cost justification for a higher price, gave great strength to the crude-oil market."

M. J. Rathbone, president, Standard Oil Co. (N. J.), in testimony before a Senate subcommittee.

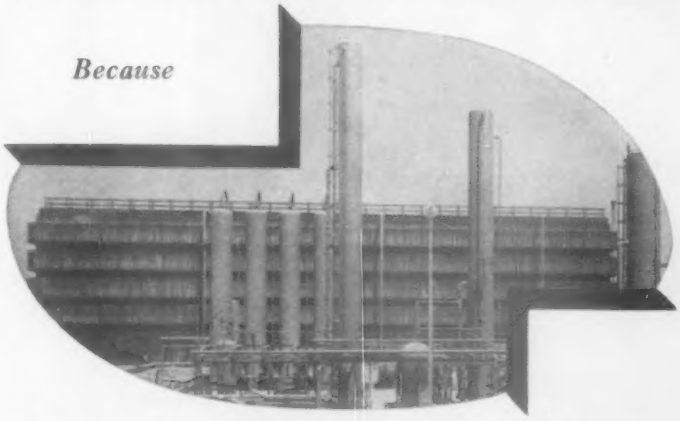
Journal management tips

Dear Sir:

After reading your 10-minute Journal feature on better management entitled "Tips on Training," February 25,

Your Plant Water Systems MORE EFFECTIVELY PROTECTED

Because



In Corrosion Inhibitors There Is A Difference

A difference which can be used to your advantage is present in the chemical composition and behavior of Haering's Organic Chrom Glucosates*.

A Chrom Glucosate* inhibitor film is tough, tenacious, elastic yet adherent, self-sealing and impervious. Is particularly effective in waters with high sulfate and chloride contents** or where process streams introduce various complex reducing contaminants. The organic Glucosates are used at low dosage rates over wide ph range. No more expensive and often cheaper to use.

Without cost or obligation find out how "Organic Methods" can provide extraordinary protection to water-using equipment in your plant.

**In use 8 years in a Cooling System where chloride content exceeds 25,000 ppm at times.

*Reg. U. S. Pat. Office

Call or write

WE READ WATER H-O-H ESTABLISHED 1931 OVER 25 YEARS OF SERVICE

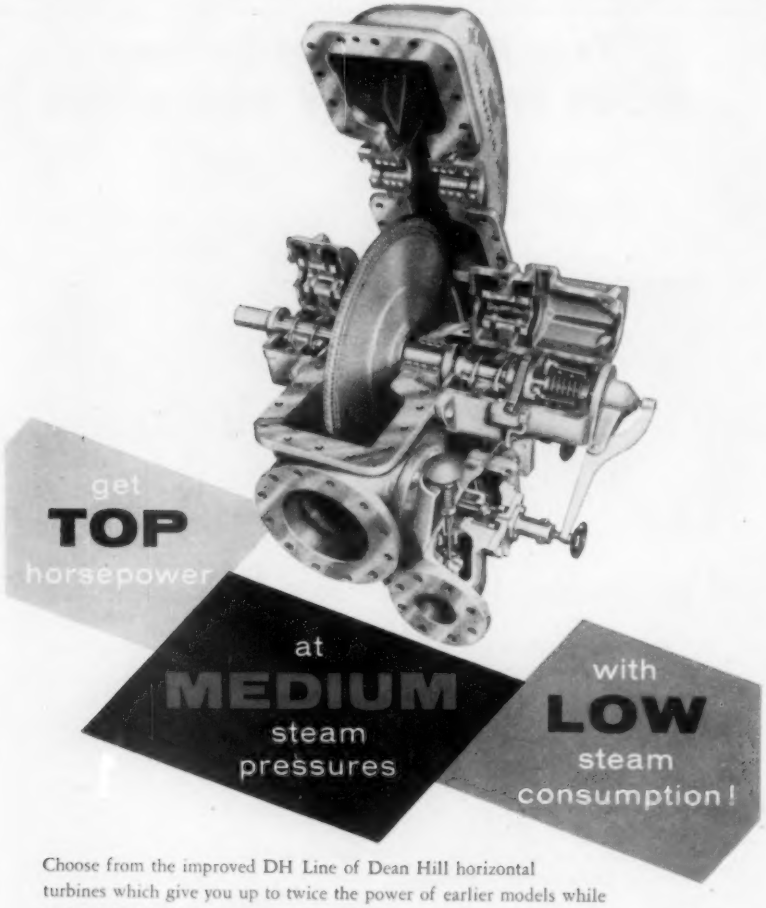
D. W. HAERING & CO., INC.
ANALYSTS · CONSULTANTS · MANUFACTURERS
P. O. Box 6037
SAN ANTONIO, TEXAS

1957, I am requesting additional copies of this article for classroom use in a management seminar graduate course at North Texas State College. Members of this course submit material and information which they consider of value to other student members, and this "Tips on Training" would be a valuable contribution.

I have shown this latest management article and two previous Journal features, "Tips on How to Give Orders," December 24, 1956, and "Tips on Trainee Instruction," January 21, 1957, to several instructors here in our school of business administration. They thoroughly concurred with me in desiring additional reprints for use in our management seminar work. There are 22 students and if possible I would like to obtain a reprint of the above three features for each of them.

It is sometimes amazing to find so many people right here "at home" who fail to realize how much they owe to oil. "Tips on Better Public Relations" or an "Enlightenment of the Masses" might even provide a basis for a new Journal management feature.

Thomas O. Kirkpatrick
Denton, Tex.



Choose from the improved DH Line of Dean Hill horizontal turbines which give you up to twice the power of earlier models while maintaining the same economy of operation.

The major change contributing to this tremendous power increase is the addition of steam nozzles to all models. On types now built with two nozzles—DH-10, DH-15, DH-20, DH-25—this change has meant *a 100% increase in the maximum horsepower of each unit!* On new three-nozzle models—DH-30, DH-35, DH-40, DH-45—the rated increase in maximum horsepower is 50%!

Why not get the complete power picture of Dean Hill's improved DH Line of horizontal turbines? Write today for Turbine Catalog, No. 500.

DEAN DH HILL PUMP COMPANY
Pump and Turbine Engineers Since 1893
Indianapolis 7, Indiana

OFFICES IN PRINCIPAL CITIES

Acknowledgments made

Dear Sir:

I am writing this letter in regard to the paper entitled "How Long Will Your Gas Last?" appearing in your March 11, 1957 magazine.

I was very well pleased and greatly impressed by the manner in which this material was presented. However, it was to my disappointment that the acknowledgments included in the draft which expressed my appreciation to various people did not appear in the publication. The cooperation of the management of Texas Gas Transmission Corp. in release of this information is hereby acknowledged. Appreciation is extended to J. Milton Wege, engineer with Ralph E. Davis, consultant.

R. D. Northcutt
Supervisor, Reservoir Engineering
Texas Gas Transmission Corp.
Houston.

CALENDAR

MARCH

27-29 American Power Conference, Sherman Hotel, Chicago.
30 North Texas Oil and Gas Association, twenty-seventh annual meeting, Kemp Hotel, Wichita Falls, Tex.

APRIL

1-4 American Association of Petroleum Geologists, Society of Economic Paleontologists and Mineralogists, national convention, Kiel Auditorium, St. Louis.
2-4 Corrosion Control, fourth annual conference, sponsored by National Association of Corrosion Engineers and the University of Oklahoma College of Engineering, University of Oklahoma, Norman, Okla.
7-10 Petroleum Equipment Suppliers Association, annual convention, Palm Springs, Calif.
7-12 American Chemical Society, national meeting, Miami, Fla.
8-10 American Society of Mechanical Engineers, spring meeting, Dinkler-Tutwiler Hotel, Birmingham, Ala.
8-11 American Gas Association, distribution conference, Houston.
9 American Institute of Chemical Engineers, Philadelphia - Wilmington section, University of Pennsylvania, conference on catalysis in practice, University Museum, Philadelphia.
9-11 American Welding Society, fifth annual welding show, Convention Hall, Philadelphia.
10-12 American Petroleum Institute, Mid-Continent district production division meeting, Mayo Hotel, Tulsa.
11 Illinois Oil and Gas Association, twelfth annual meeting, Mount Vernon, Ill.
11-12 West Texas Oil Lifting Short Course, Texas Technological College, Lubbock, Tex.
11-13 Institute of Radio Engineers, ninth annual southwestern I.R.E. conference and electronics show, sponsored by Houston section, Shamrock Hilton, Houston.

11-13 Institute of Radio Engineers, second national simulation conference, sponsored by Professional Group on Electronic Computers, Shamrock Hilton Hotel, Houston.

11-13 American Institute of Mining, Metallurgical, and Petroleum Engineers, Pacific Northwest Regional Conference, Portland, Ore.

16-18 Petroleum Industry Electrical Association annual meeting, Shamrock Hilton Hotel, Houston.

16-18 Petroleum Electric Suppliers Association, Shamrock Hilton Hotel, Houston.

16-18 Southwestern Gas Measurement Short Course, University of Oklahoma, Norman, Okla.

16-18 National Petroleum Association, fifty-fourth semiannual meeting, Cleveland.

18-19 Texas Petroleum Research Committee and Permian Basin Section of American Institute of Mining, Metallurgical, and Petroleum Engineers, tenth annual oil-recovery conference, Midland, Tex.

22-25 Canadian Institute of Mining and Metallurgy, annual general meeting, Chateau Laurier, Ottawa.

24-26 Natural Gasoline Association of America, thirty-sixth annual convention, Rice Hotel, Houston.

24-26 American Petroleum Institute, Rocky Mountain district production division meeting, Gladstone, Townsend, and Henning Hotels, Casper, Wyo.

25-27 Appalachian Geological Society, Kentucky Geological Society, joint field conference, southeastern Kentucky.

25-27 American Association of Petroleum Landmen, third annual convention, Hilton Hotel, San Antonio, Tex.

28-30 Independent Petroleum Association of America, midyear meeting, Buena Vista Hotel, Biloxi, Miss.

29-30 Automatic Control in the Petroleum and Chemical Industries, conference sponsored by the University of Oklahoma, extension study center, University of Oklahoma, Norman, Okla.

29-May 1 Southern Gas Association, annual convention, New Orleans.

MAY

1-3 American Petroleum Institute, Division of Production, eastern district meeting, William Penn Hotel, Pittsburgh.

6-8 American Petroleum Institute, annual pipeline conference, Cleveland Hotel, Cleveland.

6-8 American Geophysical Union, thirty-eighth annual meeting, National Academy of Sciences, Washington, D. C.

7 American Gas Association, committee on underground storage, operating section, Mark Hopkins Hotel, San Francisco.

8-10 American Gas Association, Pacific Coast Gas Association, gas supply, transmission, and storage conference, Mark Hopkins Hotel, San Francisco.

9 Panhandle Producers and Royalty Owners Association, annual meeting, Herring Hotel, Amarillo, Tex.

9-10 Fourth annual heat-transfer conference, Oklahoma A. & M. College, Student Union Building, Stillwater, Okla.

9-10 Symposium on use of surface active agents in water flooding, Pennsylvania State University, department of petroleum and natural gas, State College, Pa.

12-15 Liquefied Petroleum Gas Association, annual meeting, Conrad Hilton Hotel, Chicago.

13-15 Industrial Waste Conference, sponsored by Purdue University, Purdue Memorial Union Building, Lafayette, Ind.

13-16 American Petroleum Institute, division of refining, midyear meeting, Sheraton Hotel, Philadelphia.

14-16 Industrial Nuclear Technology Conference, sponsored by Armour Research Foundation of Illinois Institute of Technology and Nucleonics Magazine, Museum of Science and Industry, Chicago.

16-17 American Petroleum Institute, division of production, Pacific Coast district meeting, Hotel Biltmore, Los Angeles.

16-18 Geological Society of America, southeastern section, annual meeting, Morgantown, W. Va.

19-22 Texas Independent Producers and Royalty Owners Association, Galvez and Buccaneer Hotel, Galveston, Tex.

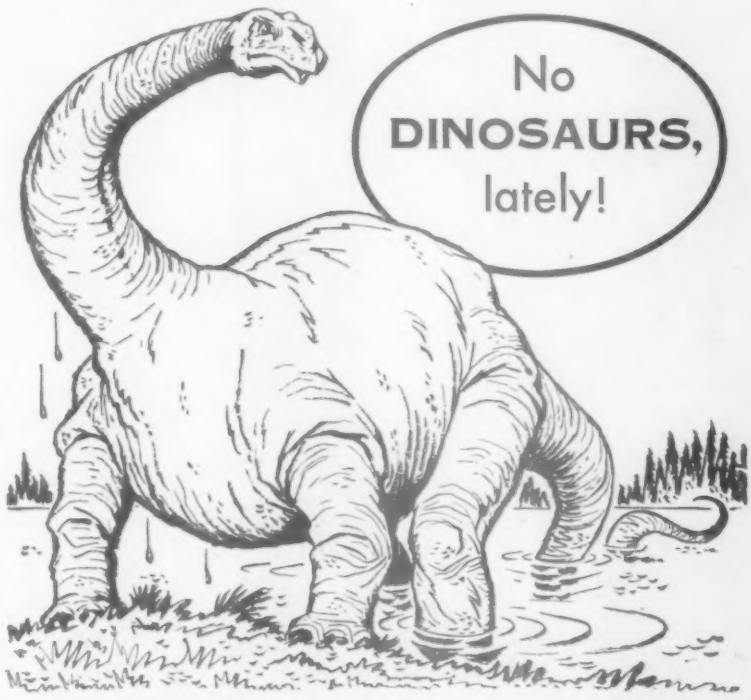
20-22 American Petroleum Institute, division of transportation, central committee on transportation by water and tanker corrosion symposium, San Francisco.

20-22 American Gas Association, chemical, engineering, and manufactured gas production conference, Balmoral Hotel, Bal Harbour, Fla.

20-23 American Society of Mechanical Engineers, twenty-ninth annual conference and exhibit of the oil and gas power division, Kentucky Hotel, Louisville, Ky.

21-23 Pennsylvania Gas Association, annual meeting, Pocono Manor Inn, Pocono Manor, Pa.

23-24 Kentucky Oil and Gas Association, annual membership meeting, Hotel Phoenix, Lexington, Ky.



The extensive magnesium silicate deposits laid down about the time dinosaurs roamed Florida's marshy peninsula became the source of today's most wisely used adsorbent.

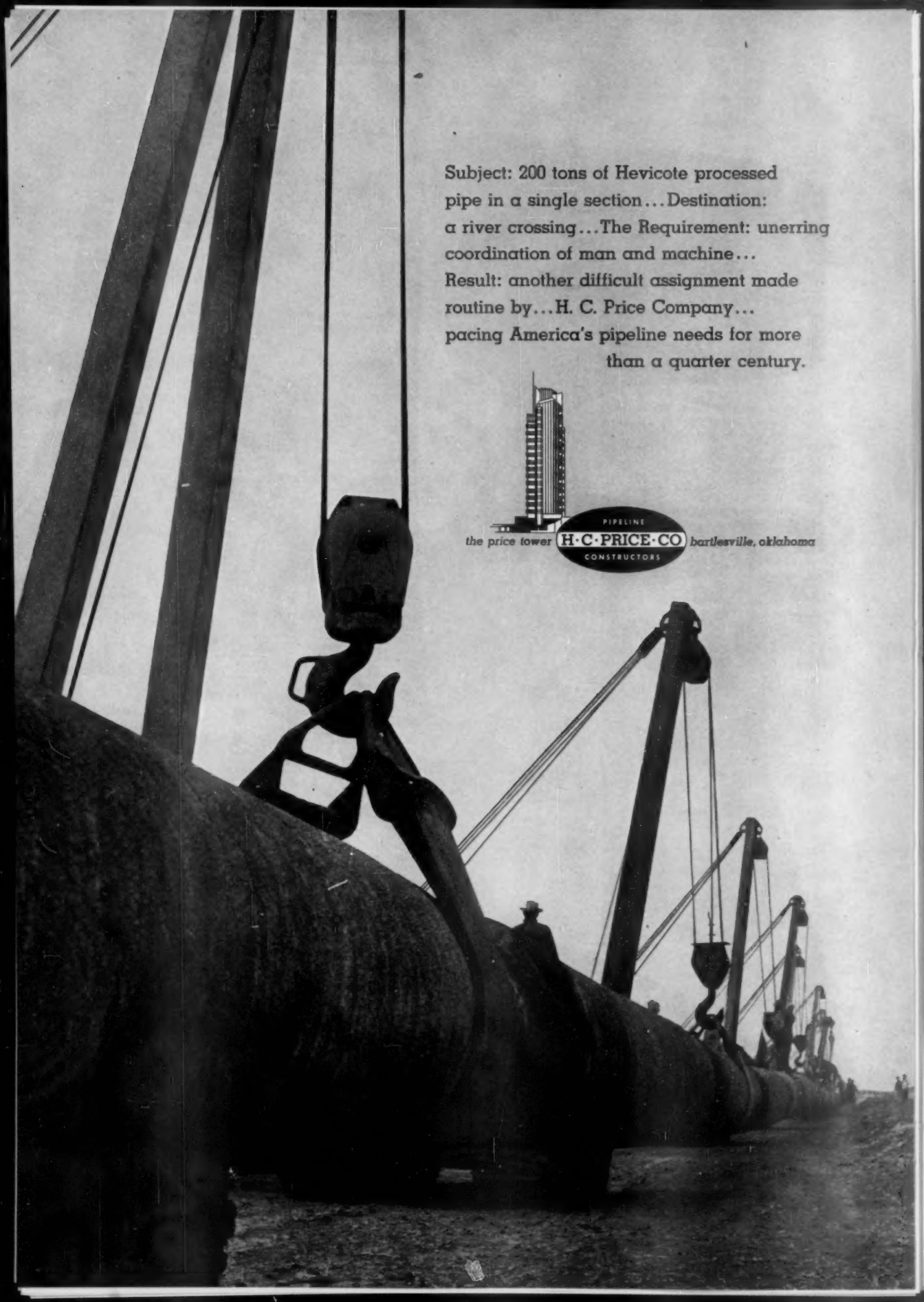
Because it contains numerous small fibrous tentacles, Florida Fullers Earth, in its commercial form known as Florex, is particularly valuable in the adsorptive refining, decolorization, clarification and neutralization of mineral, vegetable, and animal oils, fats and waxes. Florex is unequalled in high quality or low cost for processes involving the use of highly active clay for sweetening light distillates, dehydration, desulfurization, and polymerization.

Standard meshes from 2/4 to 200/up and our experienced adsorption specialists are available to help you solve complex laboratory or production problems.

FLORIDIN COMPANY

Adsorbents
Desiccants
Diluents

Dept. C P. O. Box 989 Tallahassee, Fla.


Subject: 200 tons of Hevicote processed
pipe in a single section... Destination:
a river crossing... The Requirement: unerring
coordination of man and machine...
Result: another difficult assignment made
routine by... H. C. Price Company...
pacing America's pipeline needs for more
than a quarter century.
the price tower
PIPELINE
H·C·PRICE·CO
CONSTRUCTORS
bartlesville, oklahoma

The OIL AND GAS JOURNAL

TULSA, OKLAHOMA

Published every Monday by The Petroleum Publishing Co., 211 South Cheyenne Avenue, Tulsa, Okla. Phone Diamond 3-6291. Founded in 1902. Name changed to The Oil and Gas Journal in 1910 by Patrick C. Boyle.

•

President
P. C. LAUINGER
S. H. ROURKE
Executive Vice President
MITCHELL TUCKER
Vice President and Advertising Manager
HANSON B. PIGMAN
Circulation Manager
DONALD W. WILSON
Manager Industry Census Department
J. PARKER HOLLAND
Production Manager

ADVERTISING OFFICES
TULSA
211 South Cheyenne, Diamond 3-6291
JOHN D. REILLY ... Mid-Continent Manager
ROY E. FINLEY ... Representative
D. B. MILLER ... Classified Adv. Mgr.
NEW YORK
500 Fifth Avenue, LOngacre 4-6160
E. S. KLAPPENBACH ... Eastern Manager
HARRY B. BULLEN ... Representative
PHILADELPHIA
1509 Land Title Building
Broad and Chestnut Streets,
RIttenhouse 6-0118
JOHN W. MEANY, JR. ... District Manager
CHICAGO
105 West Madison Street, CEntral 6-2537
DAVID T. KENNEY ... District Manager
KAREL WEGKAMP ... District Manager
DETROIT
204 Washington Square Building,
Royal Oak, Mich., LIncoln 7-9455
JOHN D. YODER ... District Manager
PITTSBURGH
106 Nelson Avenue, FRemont 1-7775
ALFRED M. JONES ... Manager
HOUSTON
802 Sterling Building, CApitol 4-7726
JOHN M. SPEARS ... Gulf Coast Manager
DALLAS
1238 Mercantile Bank Building,
RIverside 8-3074
PREN G. HOLLINGSWORTH Representative
LOS ANGELES
650 South Grand Avenue, VAndike 0722
GEORGE O. RUPPERT ... District Manager
ENGLAND
National Provincial Bank Chambers,
15 Grafton Street, Altrincham
Phone Altrincham 3160
HARRY BECKER ... European Representative

•

Subscription rates to the petroleum industry, United States and foreign, 1 year, $4.00; 2 years, $7.00; 3 years, $8.00. Single copies: regular issues 50 cents; special issues $1.00. Back copies when over a year old, $1.00. Note: Payments from outside the U.S.A. may be made by international money order, New York exchange, or check on a U.S.A. bank. Entered as second-class mail matter at Tulsa, Okla., under Act of March 3, 1879. Copyright 1957 by The Petroleum Publishing Co.

Member
Audit Bureau of Circulations
Associated Business Papers

JOURNALLY SPEAKING . . .

Processing Predictions

WE ourself can't claim to be much of an expert on refinery processing, but in thumbing over the proofs for this annual refining number we were tremendously impressed with the speed and complexity with which that end of the oil business has progressed in recent years.

Our first contact with catalytic cracking was back before the war on a visit to Sun Oil Co.'s Marcus Hook refinery where we saw what then was perhaps the only commercial cat cracker in the world. The unit had been put on stream experimentally in 1937—just 20 years ago—but it took a couple of years to really prove itself.

There we met the inventor of the process, a frustrated French engineer named Eugene Houdry. Houdry's frustration came from his inability to get good enough gasoline for his hobby of racing cars. So for about 10 years he had been experimenting with his theory that some sort of chemical catalyst would rearrange the gasoline molecules during refining.

To the explanation of what the catalyst did we gave a polite "uh-huh," but we were quite intrigued with the ingenious mechanical timer that switched the oil stream from one cracking "case" to another while the others were being regenerated. This converted what was essentially a batch process into the equivalent of a continuous operation, and was a happy marriage of American mass-production methods and French chemical theory. It was quite a triumph, but it started competition and it didn't take long for this batch process to be outmoded.

It was very shortly after Pearl Harbor that we were privileged to attend the world premier of so-called fluid cat cracking at Jersey Standard's Baway refinery. Again we left the fine technical points to the refining experts, but we sold an article to a non-oil magazine predicting that this new method of continuous processing by handling powdered catalyst and similar materials as though they were fluids would have wide application in many industries and might revolutionize refining and chemical processing. Looking back at it now, that wasn't a bad prediction.

By then the war was on, with the urgent need for aviation gasoline and synthetic rubber. American technical brains went to work under forced draft and hatched a whole clutch of new refining processes. But the secrecy lid was on tight, and oil reporters had a hard time learning or printing anything about the new methods. When it was all over we discovered to our dismay that refining technology had moved so far and so fast that we could never hope to understand it.

So we are content to leave the process details to the process experts, and just try to keep generally abreast of the broad trends by reading the refining articles in our favorite oil publication—which is a pretty good thing for anybody in the oil business to do.

Take today's issue, for instance. You can get a good idea of the multitudinous new processes that grew out of Eugene Houdry's dissatisfaction with ordinary gasoline by skimming through the 48 pages of flow diagrams.

Then you can tell how much use is being made of these processes and who is building what and where by referring to the tables of refinery capacities and construction.

Some "must" reading for everybody in the business—not only refiners—is George Weber's penetrating analysis of refining trends, the octane race, and the competitive position of large and small refiners.

And now we have radiation processing on the threshold. A number of oil companies are experimenting with nuclear energy and the products of atomic fission as possible means of breaking down and rebuilding hydrocarbon atoms. Will this make present refining methods obsolete? Will it produce new and hitherto unknown petroleum products?

Well, in this issue there's a symposium of opinions by experts in radiation processing. Read it and then make your own predictions. We're through predicting what's going to happen in refining. This business of developing new processes is going too fast for our nontechnical brain.

—Henry D. Ralph.

No matter how you look at it...

for...

Whatever the GRADE and the VOLUME of

NATURAL GASOLINE

Just rely on WARREN'S versatile facilities to give you dependable deliveries . . . WHERE and WHEN and the WAY you want them.

WARREN

PETROLEUM CORPORATION

TULSA, OKLAHOMA • Cable Addresses: STAVOLENE, WARREN

EXPORT TERMINALS: CORPUS CHRISTI, PORT ARTHUR, BAYTOWN, TEXAS CITY AND WARRENGAS, HOUSTON, TEXAS, SAN PEDRO, CALIF.

Refining is an industry— not just another chemical

IT looks as though our aggressive friends in the chemical business have sold a bill of goods to the Government to the effect that petroleum refining is not an industry in itself but is just another segment of the chemical industry.

The U. S. Bureau of the Budget is currently revising the "Standard Industrial Classification," which is the basis for all federal and many other statistical surveys. It proposes to abolish the present "Products of Coal and Petroleum" class and set up a new "Basic Chemicals" class of which petroleum refining would be a component.

THIS IS OUTRAGEOUS. For 3 years an A.P.I. committee has been working to get coal tar, coke, and other miscellany (comprising about 5 per cent of the total) transferred to other classifications, leaving petroleum refining to stand alone. Recently all affected industries agreed and unanimously recommended that the Budget Bureau make the change.

Then the chemical industry apparently moved in. There already is one classification for chemicals, but the new plan would provide two—"Basic Chemicals" and "Chemical Products." Since each class is supposed to represent a separate industry, this would mean that in the eyes of the Government, fuels and lubricants are just a couple of chemicals.

Figures on the refining industry, under the new plan, would be thrown in with turpentine, perfume oils, alkalis, plastics, dyestuffs, coal tar, and welding gases. That's far worse than the present grouping.

Refining statistics are meaningless to the industry and misleading to others when totaled in with coal products as at present. They would be completely buried under the new grouping. But their big percentage of the new group would make the chemical industry look mighty big and impressive.

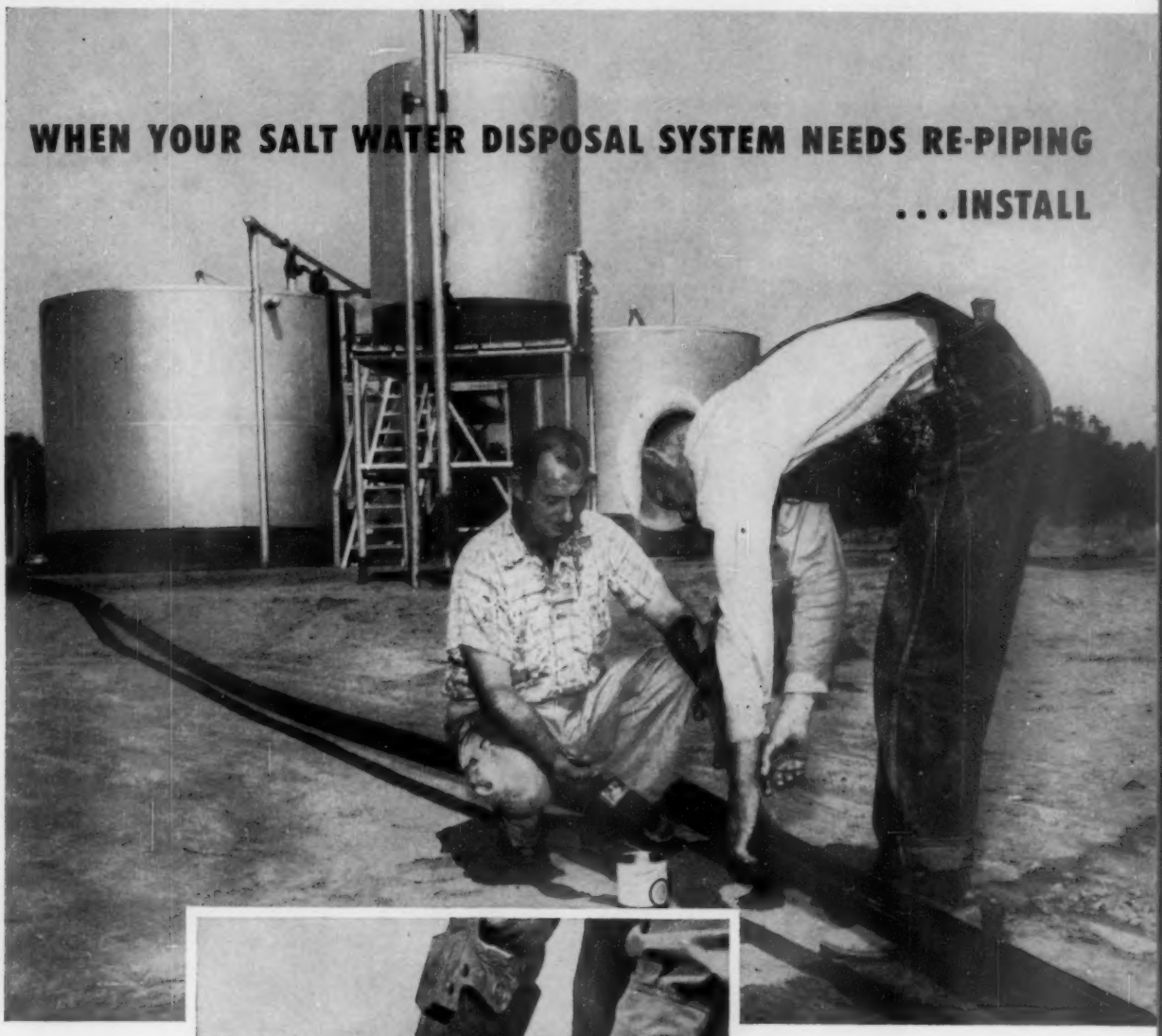
WHAT THIS MEANS is that the refining industry would never know where it stands without a detailed breakdown of the over-all figures. Most users of Government statistics wouldn't bother to do this.

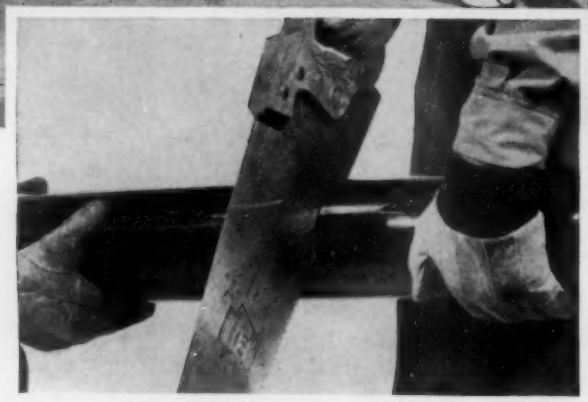
The Standard Industrial Classification is used by the Bureau of Labor Statistics, Census, and others in all major studies of employment, investment, growth, activity, sales, and other aspects of the national economy. In the future such studies may ignore refining as an industry.

THE DAY MAY YET be saved by prompt action. Refiners with a pride in their industrial identity as well as a need for usable statistics should protest.

The great refining industry should stand on its own feet. It should be recognized as the distinct entity that it is.

WHEN YOUR SALT WATER DISPOSAL SYSTEM NEEDS RE-PIPING ...INSTALL





EASY TO HANDLE ... CUT ... JOIN ... DITCH! Republic SRK Plastic Pipe is extremely lightweight, can be cut with an ordinary handsaw. Joining is easy, using brush-applied solvent. Simply coat inside of fitting, outside of pipe with cement, stab pipe into fitting, give ⅛ turn and the job is done. And the "weld" is permanent.

REPUBLIC

REPUBLIC STEEL

World's Widest Range of Standard Steels

REPUBLIC SRK

the plastic pipe that takes the bite out of corrosion

...and your pocketbook

Replacement costs will virtually disappear, because salt water *will not harm Republic SRK.* Furthermore, this amazing rubber-resin pipe is so versatile it has become a favorite for handling natural gas, oil—and many other liquids as well.

Principal reason lies in the unique advantages of this rugged pipe—advantages unmatched by any other pipe material.

It's easy to transport. Because Republic SRK is extremely lightweight, one man can carry several lengths with little effort. And once made up, he can ditch the pipe by himself.

It's easy to install. Republic SRK can be installed quickly and easily—even by workers with no previous experience in laying plastic pipe. Any ordinary handsaw will cut it. And it takes only seconds to join permanently with a brush-applied welding solution. This speed of assembly keeps installation costs down.

It's easy to maintain. Republic SRK's resistance to electrolytic action, corrosive oils and salt water, guarantees long life, fewer replacements. A carbon-black additive makes it resistant to deterioration from the sun's ultraviolet rays.

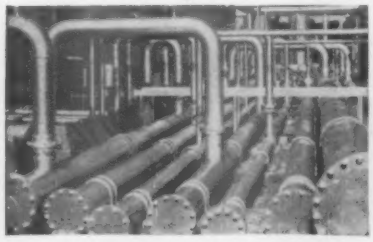
Because it's extremely tough, Republic SRK will stand up under rough treatment. Impact strength is high—and over a wide range of temperatures. Available in sizes from ½" through 6 inches in a wide range of pressure ratings.

Republic also makes Semi-Rigid Butyrate (SRB) for areas where paraffin conditions are extremely severe. It will pay you to investigate both Republic SRK and SRB. To get the complete story, *send coupon today.*

PROTECT HIGH-PRESSURE EQUIPMENT with quality Republic fasteners. The alloy studs and high carbon hex nuts in these headers are built to withstand the most severe heat, pressure and corrosive conditions. Clean, accurate threads provide easy tightening, maximum holding power, resistance to wear, trouble-free backoff. Ask your distributor, or send coupon for details.

ECONOMICAL TRUSCON® STEEL BUILDINGS erect quickly and easily. They're fire-resistant, well-lighted, properly ventilated, easy to maintain—in all, perfect for your requirements. The building shown below is one of many standard sizes and styles produced by Republic's Truscon Steel Division—world's largest manufacturer of steel building products.

CUT LINE-PIPE INSTALLATION TIME BY 33% with new Super-Span Joints of Republic Electric Fusion Weld Line Pipe. *Sixty feet in length,* they require only 88 welds to make a mile of line. Welding crews making 150 girth welds per day will complete 9000 feet. This new length, a Republic exclusive, is produced by joining two 30-foot joints under ideal welding conditions. Comes in sizes from 24" through 30" O.D. Mail coupon for facts.



STEEL

and Steel Products

REPUBLIC STEEL CORPORATION
Dept. C-3509
3112 East 45th Street, Cleveland 27, Ohio

Please send me more information on:

☐ SRK (Kralastic) Plastic Pipe ☐ Fasteners
☐ SRB (Butyrate) Plastic Pipe ☐ Truscon Steel Buildings
☐ New Super-Span Joints of Republic Fusion Weld Line Pipe

Name_____ Title_____

Company_____

Address_____

City_____ Zone_____ State_____

Good Wells Make Good News

MARCH 25, 1957

SANDFRAC®—a Dowell developed service—is one of the most widely used formation fracturing treatments. Most lease crude oils can be used in Sandfrac. If necessary, they can be modified on location with addition agents to control thickness, fluid loss and emulsions. If suitable lease crude is not available, special refined oils can be used. This versatility, plus Dowell's experienced personnel and dependable equipment, make Sandfrac a profitable treatment for many wells. Want proof? Just look at these cases.

- **Duval County, South Texas**—(Old Well)—Completed in Queen City Sandstone through perforations 5129-5133 feet in April 1956, and tested 104 BPD 43.7° gravity oil. By June, well had gone completely to water. It did not respond to acid or emulsion breaker treatments. Then it was fractured with Sandfrac, using 5000 gallons of 21° gravity crude from another zone, and 5000 pounds sand. After treatment, well produced at field allowable of 102 BOPD. At market price of $3.10 per barrel, $534.33 treatment *cost was recovered in less than two days.*

- **Kay County, Oklahoma**—(New Well)—Open hole completion in Mississippian Chat 4148-4180 feet. Well tested 5 BOPD before treatment. Sandfrac, using refined oil, was selected because of crude storage costs and relatively low acid solubility of chat in this area. 500 gallons of Mud Acid spearheaded 10,000 gallons oil and 20,000 pounds sand. Injection rate down 5½" casing averaged 25.2 barrels per minute. *Six months after treatment, production had leveled off at 40 BOPD.*

- **San Juan County, New Mexico**—(New Well)—Completed in Gallup formation of the Bisti Field. Before treatment, well tested 3.5 barrels oil per hour. Sandfrac, with 35,000 gallons lease crude and 26,000 pounds of sand, was used. Injection rate down casing was 50 BPM. *After treatment, well tested 62 BOPH.*

- **Lawrence County, Illinois**—(New Well)—Completed in tight Benoist Sandstone in open hole 1860-1873 feet, well tested only a show of oil before treatment. Mud Acid spearhead preceded Sandfrac, using 10,000 gallons of lease crude, 10,000 pounds of sand and 250 pounds of F.L.A.* (Fluid Loss Additive). Injection was down 5½" casing at 29 barrels per minute. Production after treatment was 110 BOPD, stabilizing at 65 BOPD. At market price of $2.90 per barrel, *cost of $1,700 treatment was recovered in approximately one week.*

Dowell Engineers can help you tailor Sandfrac to the requirements of your well, or they may suggest another Dowell treatment for better results. Either way, it pays to deal with Dowell. For more information or service, call any of the 165 Dowell offices in the United States and Canada; in Venezuela, contact United Oilwell Service, or write to Dowell Incorporated, Tulsa 1, Oklahoma.

*Trade Mark of Dowell Incorporated

Services for the oil industry DOWELL

A Service Subsidiary of The Dow Chemical Company

Oil industry's top brass gathers to give Texas commission a . . .

Look Ahead at 1957 Stocks and Imports

AUSTIN.—Look for a 4.6 per cent hike in domestic demand this year.

That's the composite forecast of the best economic brains of major oil companies operating in the United States.

It was made as an aid to the Texas Railroad Commission in regulating Texas oil production in 1957 and presented in person by top brass of the firms at the March 19 hearing here on the state's allowable for April.

Each executive also gave the commission his company's opinions on the most desirable levels of crude and products stocks, plus data on how much oil it expects to import daily this year.

This was the second consecutive year that the commission summoned the executives to appear in person to give it data for use as a partial guide in judging demand and fixing allowables. Before that, the agency got its dope via questionnaires.

The 4.6 per cent demand boost predicted for this year exceeded by 0.2 per cent that expected in 1956 by the same firms.

The forecasts ranged downward from a high of 5.5 per cent by Continental Oil Co. to a low of 4 per cent by Sinclair, Indiana Standard, and Sun.

Jersey Standard, the world's biggest oil firm, anticipated an increase of between 4.5 and 5 per cent.

How about stocks? . . . Generally, the majors feel that stocks of crude and products are about right now; crude a little low; gasoline too high.

The commission again this year asked the companies' opinions on ideal crude and product stock levels for April 1 and November 1. The first date heralds the beginning of the heavy gasoline-consuming season. The second is about the time refiners normally cut gasoline yields and start turning out more of the heavier products for the winter season.

The companies' ideas as to the best level for crude stocks on April 1 ranged from Conoco's 250,000,000-255,000,000-bbl. to the 270,000,000-bbl. opinions of Sinclair and Sohio.

The average was 260,800,000 bbl.—just about the same as the composite last year.

These stock figures and all others in the reports excluded pipeline fill and that below tank outlets.

Actual U. S. crude stocks totaled roughly 252,000,000 bbl. as of March 9.

For November 1, the composite "ideal" level is 265,100,000 bbl. for crude—a bit higher than last year.

Gasoline picture . . . Company feelings on gasoline stocks, however, have changed drastically in the past year.

The averages this year are 187,800,000 bbl. for April 1 and 153,600,000 bbl. for November 1. The composite level in each case is roughly 10,000,000 bbl. above that set by the companies as "ideal" last year.

Even so, gasoline stocks now are about 20,000,000 bbl. higher than the companies would like for April.

For April 1, Conoco was again the highest with 200,000,000-205,000,000 bbl. Gulf on the other hand fixed the ideal level for this time of year at 160,000,000 bbl.

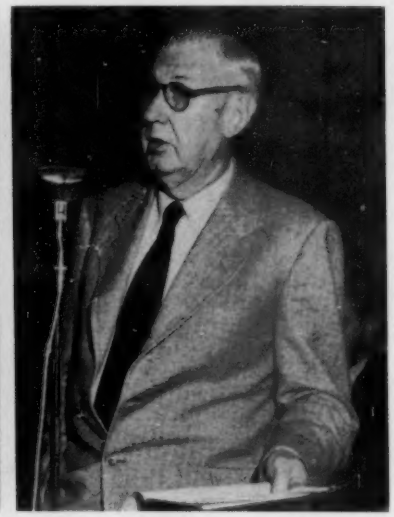
High and low opinions for November 1 were 180,000,000 bbl. by Southwestern Oil & Refining Co. and 125,000,000 by Gulf, respectively.

For other products . . . The companies sized up ideal stock levels of the other products this way:

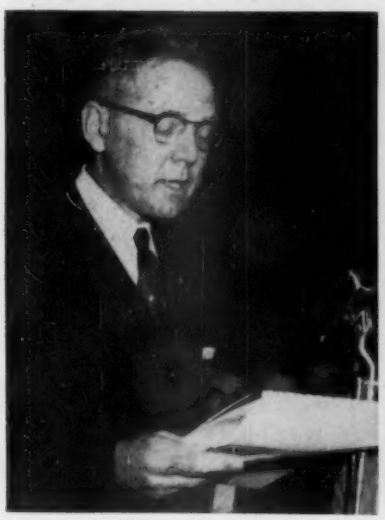
For kerosine on April 1 the average was 18,500,000 bbl. The high was 21,-

What Top Executives Said in Austin:

TEXACO'S C. B. BARRETT
... 5 per cent demand hike ... Crude stocks are a bit low, gasoline and distillate too high.



HUMBLE'S J. A. NEATH
... Europe's getting more oil than we thought. Big boost came too late.



SUN'S R. G. DUNLOP
... Can't tell when Sun can resume Middle East imports blocked off at Suez.

CITIES SERVICE'S P. S. WATSON
... There appears to be little coordination between producing, refining departments.

000,000 bbl., the low 16,000,000 bbl. The November 1 average was 36,100,000 bbl., the high 38,000,000 bbl., the low 35,000,000 bbl.

For distillate, the ideal average level for April 1 was 65,500,000 bbl., the high 80,000,000 bbl., and the low 55,000,000 bbl.

The November 1 figures averaged out to 157,800,000 bbl. and ranged from a high of 170,000,000 bbl. to a low of 140,000,000 bbl.

For residual, the April 1 average was 38,500,000 bbl., the high 41,000,000 bbl., the low 33,000,000 bbl.

The ideal average for November 1 was fixed at 49,900,000 bbl. with opinions ranging from a high of 55,000,000 bbl. to a low of 45,000,000 bbl.

Planned imports up . . . Importers said they now plan to bring in 47,678 bbl. daily more crude oil this year than was anticipated last year at this same time.

Sixteen firms told the commission they plan to import an average of 925,900 bbl. of crude this year. This contrasts with total crude imports planned by 17 firms this time last year of an average 878,222 bbl. daily.

Lower products imports planned this year, however, cut total crude and products imports below those forecast for 1956.

The companies now plan to import only 233,300 bbl. of products daily this year as against 364,179 bbl. daily last year, a drop of 130,879 bbl. daily.

The drop in planned total imports of crude and products is 83,201 bbl. daily.

Company executives advised the commission, however, that it is nearly impossible to plan imports accurately a year ahead with the international situation as it is now.

The import figures filed, they said, have to be based on certain assumptions. These include when the Suez will reopen and when the full pipeline flow of oil from Iraq will resume. They are at best only good guesses.

Warnings . . . Company brass this year gave the commission the information it asked in quick order. There was little needling or cross-examination by the commissioners.

Humble Oil & Refining Co. was twitted both by Olin Culberson, chairman, and E. O. Thompson for its steady push in recent months (until April) for higher Texas oil allowables.

Thompson pointed out to Humble's J. A. Neath, board chairman, that there has been surplus oil since the commission finally raised the March allowable to a high level which Humble had recommended.

The interplay followed testimony by Gulf Oil Corp.'s R. K. Huggins, vice president, that West Europe is now turning down U. S. offers to sell oil. And in some cases deals already made are being canceled. This, he said, is despite the fact that the Suez Canal isn't yet open to large tankers.

Warnings were voiced by several of the companies that the commission and other state oil bodies should be ready to slash allowables quickly when the Middle East oil flow returns to normal.

Otherwise, they said, the U. S. market picture could get very sloppy.

If this back-to-normal movement is carried out quickly and wisely, they agreed, the American oil industry again this year will set new records in all its divisions.

Crude Line Loops Awarded

EDMONTON.—Work is getting under way on 100 miles of 30-in. looping of Trans Mountain Oil Pipe Line Co. to increase capacity of Edmonton-to-Washington crude line to 240,000 bbl. per day.

Dutton-Williams Brothers, Ltd., has the contract for 50 miles from the pumping station just west of Edson to Pocahontas, near Hinton, Alta. R. A. Conyes Construction Co. was awarded the other 50-mile section east of Kamloops, B. C.

Texas Oil Piles Up Again

● Some crude is going begging on West European market; that's why Texas moves to choke off production in April

AUSTIN.—Final proof that West Europe is over the hump of its oil crisis was produced by major crude buyers last week.

And acting on their testimony, the Texas Railroad Commission sliced a big chunk off an all-time record Texas allowable in setting permissible flow next month.

April's production allowable in Texas will be 3,564,665 bbl. daily based on a 16-day flow pattern.

The April figure means a cut of 224,710 bbl. daily from the permitted flow on March 16. Next month's allowable is fixed right where 10 of the 13 buyers wanted it. Sun Oil Co. asked for a 17-day schedule, while Shell Oil Co. and Gulf Oil Corp. wanted 15 days.

Crude going begging . . . Buyer testimony at the hearing indicated crude stocks are piling up again not only in the West Texas trouble area but also on the Gulf Coast.

Gulf's Vice President R. P. Huggins said the industry is offering oil to Europe without takers. European buyers, he said, are even "canceling some commitments."

Evidence on the same line came from Humble Oil & Refining Co. and Magnolia Petroleum Co. Humble said it had a firm European demand for 2,900,000 bbl. of crude during April. But it can meet this demand, it said, by buying crude from other firms which will have more than they want on 16 days.

Charles Shaver of Humble told the commissioners his company already had arranged to buy 1,000,000 bbl. and has located another 1,500,000 bbl. available for spot purchase near tanker-loading points. Shaver said Humble thinks the rest wouldn't be hard to find on a 16-day schedule.

E. O. Thompson, commission member, twitted Humble's board chairman, J. A. Neath, about the present rapid buildup in crude stocks in Texas. He asked Neath if he felt the commission had been wrong last month when it hiked the allowable strongly on urging of Humble and others.

Neath said he had to admit the commission made a mistake. He added he felt the boost came too late.

Pipeline proration again . . . The April allowable was the fastest and smoothest in many months.

Independents who had participated vigorously in allowable hearings for the past 4 months this time had nothing to say.

One new distress area appeared, however. John Munn, Shamrock Oil & Gas Corp., told the commission his company is connected to 11,000 bbl. daily of production in the Texas Panhandle it can neither process nor sell.

Shamrock will stop taking trucked oil from Kansas and Oklahoma fields April 1, Munn said. But there will still be 8,000 bbl. daily in the Cactus area of the Texas Panhandle without a market next month despite this action.

Munn said his company could dispose of only 22,000 bbl. of the 33,000 bbl. daily its connections should be producing this month.

STACKS OF FACTS arm commission for a . . .

Pipeline Showdown in Texas

AUSTIN.—The stage is set for the showdown hearing here April 1 on lack of pipeline capacity out of North and West Texas to the Gulf Coast.

Independents and majors operating pipelines at that time will lock horns before the Texas Railroad Commission. The issue is producers' charges that the majors are deliberately choking West and North Texas output to bring in more imports.

Most of the pipelines have complied with the commission order requiring them in effect to turn their files inside out. Eighty per cent, including all the large lines, have submitted tons of data on gathering and transmission activities, ownership, costs and profits, past and planned expansions, and more.

Now it is up to the commission staff to wade through the tremendous tabulating job it must do on this data before April 1.

Pipeline operators must show at the hearing, the commission says, why they should not be compelled to expand capacity, extend their gathering systems to connect all wells in their operational areas, and reconvert to crude service any products line taken out without permit.

Independents are firing particularly at six major buyers. These are accused of controlling or operating all pipelines carrying crude to the Gulf Coast. The companies are Gulf Oil Corp., Humble Oil & Refining Co., Shell Oil Co., The Texas Co., Atlantic Refining Co., and Magnolia Petroleum Co.

The producers claim all these big firms are large importers and have failed intentionally to enlarge line facilities. The resulting lack of capacity is used as an excuse for selective buying, for not making new connections, and for importing oil to meet demand.

The Journal's Forecast of U. S. Refining . . .

	Crude	Vacuum	Thermal Cracking	Cat Cracking
Total Capacity 1/1/57	9,569,182	2,623,620	2,330,310	3,988,565
Construction 1957	230,280	129,830	44,000	112,200
Total Capacity 1/1/58	9,799,462	2,753,450	2,374,310	4,100,765
Construction 1958	188,900	101,440	—14,000	266,150
Total Capacity Early 1959*	9,988,362	2,854,890	2,360,310	4,366,915

*This and all other 1959 figures include all projects either under way, contracted, or firmly planned.

A double trend for refiners . . .

. . . Capacity and Quality Both on

George Weber
Refining Editor

THE U. S. refining industry has attained a record capacity for processing petroleum and producing high-quality fuels and lubricants.

The year 1957 not only finds the industry bolstering its potential for higher quality, but it also is maintaining a "cushion" on basic capacity in the interest of national defense.

Other highlights spotted by The Oil and Gas Journal's new refining survey reveal:

. . . **Crude capacity** itself is up 611,000 bbl. per stream day from a year ago.

. . . **Versatile new hydrogen-treating** operations are attracting more and more refiners. They added almost 450,000 b.p.s.d. to capacity during the past year. Plans for this year call for building units to process 528,000 more b.p.s.d.

. . . **Alkylation** is beginning to get a larger play. This time, it is being pushed upward because of motor-fuel octane requirements.

. . . **Catalytic cracking** shows signs of slowing. Refiners are nearing their saturation point on admissible feed stocks to process. The trend still is upward in relation to crude capacity, however. And it is possible that catalytic cracking capacity some day will reach 50 per cent of crude capacity on a national average.

. . . **Catalytic reforming** continues to boom. It does not show the headlong pace of the early 1950's. But many refiners now are adding their second units—some their third. The prospect is for continued growth in cat reforming in relation to crude capacity.

. . . **Thermal cracking** capacity is essentially static. Older units are being retired at a brisk rate. In the recent past, new coking units had partially offset this general abandonment of thermal processing. But present prices paid for heavy fuel oil and for asphalt are delaying the plans of some refiners to install coking.

A conservative look . . . Historically, the 1-year projection of basic refining capacity, counting all announced construction projects, has been conservative.

For example, last year the 1956 figures plus all reported plans for expansion on crude, fell short of the actual 1957 level by 178,197 b.p.s.d. This means that capacity is raised not only by new units, but also by removing bottlenecks and rescheduling runs. These efficiency factors are not as easy to predict as new construction.

It is probable that the projection on crude capacity to 1958 and 1959 may also be on the low side. If this proves true, the U. S. industry will pass the 10,000,000 b.p.s.d. mark in capacity some time in 1958. Forecasts here include only those projects which are sufficiently firmed up to permit refiners to quote actual capacity figures. Not included are planned new refineries whose capacity aggregate capacity approaches 200,000 b.p.s.d.

There has been much talk about over-capacity in U. S. refining. Despite this, refiners continue to step up capacity. Last year's "cushion" of weighted calendar day capacity over daily runs was about 866,000 b.p.d. This year, it approaches 1,000,000 b.p.d.

The inclusion this year of crude capacity on both the calendar day and stream day basis presents for the first time a direct comparison of the two figures in the same survey. January 1 totals show calendar-day capacity at about 95 per cent of stream-day capacity. This verifies the rule-of-thumb factor which generally has been applied in converting from one to the other.

Recycle rates climbing . . . In cat cracking operations, the nation's capacity for total feed to reactors continues to make more room for recycle stocks.

A year ago, this factor was surveyed for the first time. The figures reported by individual companies represented their over-all operations. On January 1, 1956, all the cat cracking reactors in the country showed a capacity for 3,709,332 b.p.s.d. About 23.6 per cent of this was used for recycle stocks. This approximates a recycle rate of nearly 31 per cent of fresh feed.

This year, the 2,988,565 b.p.s.d. in total reactor capacity shows recycle occupying about 24.0 per cent, or 32 per cent of fresh feed. New units planned for this year and next show a planned recycle rate even higher. New units now planned or building, will show a weighted average of 24.9 per cent recycle, based on total feed capacity.

These figures on recycle capacity are based on individual units for which recycle figures are reported. They represent over 95 per cent of all units in the U. S. Each unit capacity figure is broken down into fresh feed and recycle, and the averages are computed from the national totals on each type of feed.

The national capacity in catalytic cracking currently stands at 41.2 per cent of crude capacity. From available

Cat Reforming	Hydrogen Treating	Alkylation	Polymer-ization	Lubes	Coke	Asphalt
1,247,657	878,955	272,619	143,611	191,906	14,392	431,721
269,550	528,175	38,120	3,295	530	555	5,460
1,517,207	1,407,130	310,739	146,906	192,436	14,947	437,181
189,370	166,880	23,220	4,085	.....	170	12,000
1,706,577	1,574,010	333,959	150,991	192,436	15,117	449,181

Upswing

data now at hand, it promises to approach 44 per cent by 1959.

Cat reforming—still strong . . . Introduction of stepped-up premium gasoline grades and 100-plus third grades last year kept reformer builders busy.

The total capacity passed the 1,000,000 b.p.s.d. mark late last summer. A total of 1,706,577 b.p.s.d. is now in sight for some time in 1958. This represents more than 17 per cent of projected crude capacity. The 20 per cent figure seems likely before 1960.

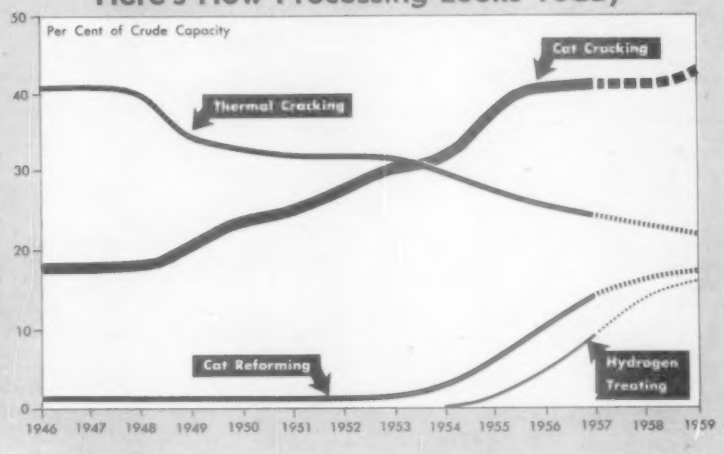
From the standpoint of process types, the base is broadening. Rexforming came into the picture last year in operating units, and early this year the first U. S. Iso-Plus unit came on stream. Both of these processes employ extraction of reformate to separate high-octane from low-octane stocks. The latter can be recycled through the same unit, thermally cracked, or withdrawn.

Last year also saw an upsurge in the capacity of several processes. Platforming, which has maintained a long lead on the field, gained over 114,000 b.p.s.d. in operating capacity last year; and 278,000 more b.s.p.d. are slated for this year and next.

Other heavy gains are ahead for Ultraforming, Sovaforming, Sinclair-Baker, and Houdriforming capacity. The fixed-bed processes are getting all of the play today. Fluid hydroforming has no takers at present, and the capacity level appears likely to remain at the 60,000-b.p.s.d. point for the foreseeable future. The same is true of the moving-bed processes, Thermofor cat reforming and Hyperforming.

The prospect for platinum-type catalyst, fixed-bed processes remains bright, however. Increased adoption of

Here's How Processing Looks Today



Independents, Majors Are Neck and Neck

	Companies controlling over 100,000 B.P.D. crude capacity			Companies controlling less than 100,000 B.P.D. crude capacity		
	1-1-57	1-1-58*	1-1-59†	1-1-57	1-1-58*	1-1-59†
Number of companies	20	20	20	161	162	162
Number of refineries‡	122	122	123	195	198	198
Crude capacity, B.P.C.D.	7,287,150	7,371,550	7,546,950	1,732,231	1,864,481	1,864,481
Crude capacity, B.P.S.D.	7,739,342	7,827,542	8,016,442	1,829,840	1,971,920	1,971,920
Per cent annual change	+5.8	+1.1	+2.4	+1.1	+0.8	0
Per cent of U. S. total	80.9	79.9	80.2	19.1	20.1	19.8
Cat cracking capacity	3,379,450	3,401,950	3,653,100	609,115	698,815	713,815
Per cent on crude	43.6	43.5	45.6	33.3	35.5	36.2
Cat reforming capacity	1,027,687	1,222,707	1,396,977	219,970	294,500	309,600
Per cent on crude	13.3	15.7	17.4	11.9	14.9	15.7
Hydrogen treating capacity	774,155	1,242,805	1,390,285	104,800	164,325	183,725
Per cent on crude	10.1	15.9	17.4	5.7	8.3	9.3
Alkylation capacity	247,409	279,139	295,859	25,210	31,600	38,100
Per cent on crude	3.2	3.6	3.7	1.4	1.6	1.9
Polymerization capacity	107,689	107,689	111,774	35,922	39,217	39,217
Per cent on crude	1.4	1.4	1.4	2.0	2.0	2.0

*Estimated. †Includes firm projects due for completion in 1958. ‡Includes 11 plants not charging whole crude (see page 170).

Cat Cracking . . . is leveling off a bit.

(Barrels per stream day)

Type—	1-1-54	1-1-55	1-1-56	1-1-57	Per cent recycle	Est. 1959	Per cent recycle
Fluid	1,940,702	2,362,830	2,694,312	2,975,785	23.0	3,291,135	23.7
T.C.C.	602,919	652,700	733,520	727,070	28.8	762,270	29.7
Houdriflow	105,000	123,020	203,800	215,980	24.6	243,780	28.1
Houdry F. B.	163,390	128,550	55,300	48,300	...	48,300	...
Cycloversion	17,850	13,750	22,400	21,430	...	21,430	...
Total	2,829,861	3,280,850	3,709,332	3,988,565	24.0	4,366,915	24.9

Cat Reforming . . . still going strong.

(Capacity, barrels per stream day)

Type—	1-1-54	1-1-55	1-1-56	1-1-57	Est. early 1959
Platforming	107,192	277,690	525,472	639,562	803,532
Ultraforming	...	24,750	103,150	158,370	238,590
Sovaforming	...	9,000	9,000	87,300	120,300
Sinclair-Baker	...	19,000	37,000	84,000	119,500
Houdriforming	23,540	28,540	58,220	62,500	104,730
Hydroforming fluid	2,000	61,450	61,450	62,000	62,000
Hydroforming F.B.	71,100	67,300	42,865	32,875	32,875
Catforming	20,010	42,550	39,612	27,950	59,950
Iso-plus	...	...	...	45,000	45,000
Powerforming	...	...	5,500	5,500	35,500
Thermofor C.R.	...	19,000	35,000	32,000	32,000
Rexforming	...	...	...	9,500	30,500
Hyperforming	...	1,000	1,000	1,100	1,100
Cycloversion	25,250	19,050	8,200	...	...
Undisclosed	...	...	...	...	21,000
Total	249,092	569,330	926,469	1,247,657	1,706,577

Hydrogen Treating . . . 1957 is the big year.

(Capacity, barrels per stream day)

Type—	1-1-55	1-1-56	1-1-57	Est. early 1959
Unifining (U.O.P.-Union Oil)	30,250	205,005	364,405	529,510
Hydrofining (Esso)	60,000	113,800	133,300	268,300
Hydrofining (Indiana)	...	34,600	124,700	253,800
Sovafining (Socony Mobil)	...	...	67,300	147,550
Gulfining (Gulf)	...	...	50,000	90,000
Hydrodesulfurization (Sinclair)	...	10,000	27,000	75,000
Vapor Phase Hydrodesulfurization (Shell)	23,000	31,000	49,600	49,600
Hydrodesulfurization (Kellogg)	3,000	3,000	3,000	42,500
Hydrotreating (Texaco)	...	11,100	16,650	27,750
Hydropretreating (Houdry)	...	13,500	13,500	20,500
Diesulforming (Husky)	1,000	1,000	1,000	1,000
Platreating (U.O.P.)	...	...	500	500
Own (Ashland, Phillips, Richfield)	...	10,000	28,000	48,000
Undisclosed	...	...	...	20,000
Total	117,250	433,005	878,955	1,574,010

Alkylation . . .

. . . picking up for octanes.

	Cap., bbl. per stream day— Sulfuric	Hydrofluoric	Total
1-1-55	186,614	49,614	236,228
1-1-56	197,869	65,540	263,409
1-1-57	212,659	59,960	272,619
Early 1959 (est.)	263,209	70,750	333,959

Coking . . .

. . . slowing up temporarily.

	Cap., bbl. per stream day— Delayed	Batch	Fluid	Total
1-1-55	243,800	35,290	3,800	282,890
1-1-56	296,500	27,290	13,800	337,590
1-1-57	304,755	43,860	105,800	454,415
Early 1959 (est.)	315,755	43,960	110,600	470,315

extraction and recycle techniques and the broadening base of admissable feed stocks, due to hydrogen treating, both point to a steady increase in cat reforming operations as compared to crude runs.

Hydrogen-treating boom . . . This is the big year for hydrogen treating. National capacity last year jumped 363,000 b.p.s.d. to about 796,000 b.p.s.d. And 607,000 more b.p.s.d is earmarked for completion before the end of 1959.

This versatile process is used to desulfurize and otherwise improve petroleum fractions from wax to naphtha.

Of the 878,955 b.p.s.d. in hydrogen-treating capacity in operation at the first of the year, about 585,000 b.p.s.d. is in use on naphtha-charge stocks. Most of these units are tied into catalytic reformers as pretreaters. This will continue to be the chief usage of hydrogen treating for some years ahead.

The remaining 274,000 b.p.s.d. in capacity is used to upgrade various middle distillates such as virgin gas oil, diesel fuel, kerosine, stove oil, tractor fuel, cat-cracking feed stock, and cat-cracking cycle stocks. This latter practice is catching on, and roughly 50,000 b.p.s.d. in existing capacity is estimated to be in use for such streams.

Another 19,000 b.p.s.d. is being used to treat lubricating-oil fractions, waxes, and specialty products in that general line. This comprises a light treatment in most cases to saturate olefins and remove traces of sulfur, nitrogen, oxygen, and other contaminants.

The picture of new hydrogen-treating capacity conforms generally to present usage. About 67 per cent of new capacity will be used on naphtha stocks. The remainder will go into service on various middle distillates. No units to treat residuals or whole crude are yet scheduled for construction, although processes have been developed to handle this more severe type of operation.

Total capacity in these varied hydrogen-treating processes will exceed that of catalytic reforming before 1960 from present indications. Projections of new capacity are considered conservative. These projections are based only on units which are firmly budgeted.

In a new technique like hydrogen treating, which is gaining rapid adoption, units can be planned and built well within a year's time. Probably, the 1,407,130-bbl. figure for January 1, 1958, will prove low. The further extension into 1958 is believed even more conservative. Many companies who will add new capacity next year have not yet completed engineering them.

Independents holding their own . . . How do the majors and independents

fare in this headlong processing race? They're both strongly in it.

It is risky to generalize in discussing these two classes of operators. Some small refiners are industry leaders in their potential for making high-octane gasoline and other quality products. On the other hand, some major companies have been slow in adopting catalytic reforming and hydrogen treating. Grouping all small refiners together also weights the class with a large number of small skimming plants which do not attempt to compete with a full line of products.

With these obvious qualifications, the side-by-side comparison of the big companies and the smaller ones shows that the independents are holding their own in most areas.

From the standpoint of total crude capacity, the picture shows a standoff. In fact, the smaller refiners are adding to capacity at a slightly higher rate than the majors.

The greatest lag on the part of the small and medium-sized refiner is in catalytic cracking. The major companies have led in this field from the first. They maintain an average of better than 40 per cent on crude, as compared with 35 per cent for the smaller companies.

The smaller companies, on the other hand, were the first to adopt cat reforming and led the majors for several years in this category. However, a number of major building programs on the part of of the larger companies have brought them even with smaller competitors. They brought themselves up to par a year ago, and their percentage of reforming capacity on basic crude capacity is now slightly higher.

In hydrogen treating, the smaller companies also lag behind, but not by a large margin. Alkylation has long been practiced by the majors for the aviation gasoline market. But this year and next will see several smaller companies installing such units to boost their octane potential in motor fuel.

When those refineries maintaining no catalytic processing facilities are removed from the smaller refiners' class, this category shows itself to be in a vigorous position.

Specialty plants . . . There are today 99 refineries in the U. S. which charge crude but do not have any catalytic processing—not even cat polymerization.

Most of them are specialty plants. They make asphalt, lubes, heavy fuel, jet fuel, etc. They are not competitive with other refineries for gasoline octanes.

Of this total, 19 with an aggregate crude capacity of 206,058 b.p.s.d. are operated by the major companies controlling 100,000 b.p.s.d. or more in crude capacity. The remaining 80, owned by smaller companies, have a total crude capacity of 245,930 b.p.s.d.

When this class of plant is withdrawn from the comparison of big refiners vs. small refiners, a better basis results for rating octane potential of the two groups. And the so-called "independents" look very good. They still lag the majors on cat cracking with 38.5 per cent against 45 per cent, based on their respective crude capacities.

The smaller outfits maintain a relatively higher capacity in cat reforming (13.9 vs. 13.6 per cent of crude capacity). Moreover, as a class they show themselves keeping well up on hydrogen treating (6.6 vs. 10.2 per cent) and alkylation (1.6 vs. 3.3 per cent). They lead the majors on poly capacity with 2.3 vs. 1.4 per cent of total crude capacity.

In summary, it appears that the small refiner is far from being left behind in the processing parade. In general, he is holding his own not only in market volume but also in his potential to make maximum yields of high quality products.

In the current standings, the top 20 companies in order of their rank in crude capacity are:

1. Standard Oil Co. (N. J.)
2. Standard Oil Co. (Ind.)
3. Socony Mobil Oil Co.
4. The Texas Co.
5. Shell Oil Co.
6. Gulf Oil Corp.
7. Standard Oil Co. of California.
8. Sinclair Refining Co.
9. Cities Service Oil Co.
10. Phillips Petroleum Co.
11. Sun Oil Co.
12. Tidewater Oil Co.
13. The Atlantic Refining Co.
14. Union Oil Co. of California.
15. Pure Oil Co.
16. Ashland Oil & Refining Co.
17. Continental Oil Co.
18. Standard Oil Co. (Ohio)
19. Richfield Oil Corp.
20. D-X Sunray Oil Co.

Trend in construction . . . New building projects coming up this year total less than those completed in 1956.

This will be a fairly slack year for building new large refineries. But 1958 looks like another busy one for the contractors. Several new grass-roots refineries are in the planning stage, and a number of ambitious projects at existing refineries will get under way late this year and early in 1958.

One new process type is expected to show first signs of commercial application by late this year. Isomerization of pentanes, hexanes and heptanes is now ready for use. While several processes have been developed, octanes have not yet reached the level where refiners need to resort to this further processing step. But as reforming severity rises and the octane cushion refiners now have becomes thinner, isomerization is expected to find a place. It will be the next category to be added to The Oil and Gas Journal's annual refining survey.

About the Survey . . .

The figures used in this report are based on The Oil and Gas Journal's Annual Refining Survey, which begins on page 170. This detailed listing of plant-by-plant capacity from crude to asphalt represents the industry's operating standing as of January 1, 1957. It is followed by a similar report on Canada, and a compilation of all new construction projects which were building, contracted, or planned at the first of this year.

This information is submitted by the companies. The standing of this survey is attested by the fact that literally 100 per cent returns were received on the questionnaire form sent out. Such cooperation is typical of the oil business.

Each year the Journal has asked several refiners to add some new facet to the survey. If something new will shed more light on the status of refining without invading privacy, it is included. This year an addition was basic crude capacity in terms of barrels per calendar day, as well as the stream day capacity.

The survey has the advantage of continuity—it has been published annually for more than 30 years. U. S. and Canadian refiners have made it their survey by their cooperation.

One word about reconciling figures in this report with those in the survey proper.

In a few cases capacity data were received in terms of barrels per calendar day. These figures were not altered—they appear opposite each individual plant identified as b.p.c.d. Since all other figures are reported on a stream-day basis, these b.p.c.d. figures were converted to b.p.s.d. before making out state totals. The factors used are. B.p.c.d. equals 0.95 times b.p.s.d. for crude and vacuum capacity, and 0.90 for all other process capacity.

Also some totals in this report will not agree exactly with the national totals appearing in the beginning of the survey. This report includes capacity of 11 plants which process petroleum fractions but do not charge whole crude. Since they are not considered conventional refineries, they are not included in the basic survey but are listed in an appendix. They include asphalt plants, lubricating-oil plants, and a few small processing units which handle crude fractions obtained elsewhere.

One other discrepancy will be noted in hydrogen-treating capacity. The figures on these pages are greater than the totals in the survey for two reasons: Some new projects came to light after the main survey went to press . . . Some companies do not report hydrogen-treating capacity which is packaged with their reformers. These packaged units are included in this report, but do not show up in the main survey.

Canada Gets A Refining Boom

REFINING competition is growing in Canada.

Outstripping all other major nations in industrial growth, Canada also shows a high annual increase in demand for petroleum products. The Canadian refining industry not only has kept pace with the upsurge in demand, but also it has made itself stronger by supplying a successively larger part of the market.

Basic crude capacity grew 9.8 per cent last year. Another gain of 9 per cent lies ahead for 1957. This projection is considered a firm one. It is based on returns from all Canadian refiners. Last year's estimate of crude capacity for January 1, 1957, missed the mark by less than 3,000 bbl. or 0.5 per cent.

High on quality . . . The pattern is much the same in the catalytic processes aimed at raising product quality.

Canada now maintains cat-cracking capacity amounting to 45 per cent of its crude capacity. This is the highest national average in the world, even exceeding the U. S. industry average of 42 per cent.

On catalytic reforming, Canadian refiners will be on a par with their U. S. counterparts by next year. They also are adding new hydrogen-treating facilities at a brisk pace.

New competition . . . This new growth in Canadian refining capacity comes not from existing operators alone.

One new major company, Canadian Petrofina, Ltd., is now an established part of the nation's oil economy. The past year has brought two more major companies into the Canadian refining picture.

Next year, Cities Service Oil Co., Ltd., will commence operating a 20,000-bbl. refinery near Toronto. This plant will comprise a two-stage crude unit, cat cracking, cat reforming, and hydrodesulfurization. It is designed for ready expansion.

Then British Petroleum's BP Canada, Ltd., has plans for a 30,000-bbl. plant to be built at Montreal East. This will be another modern refinery in every respect.

With acquisition of Trinidad Leaseholds by The Texas Co. last year, it now appears likely that Texaco's Canadian subsidiary, McColl - Frontenac Oil Co., Ltd., will merge with Regent Refining (Canada), Ltd. This will give the surviving company a larger share of the growing Canadian market.

Others expanding . . . The veteran Canadian companies are not standing still, either.

Two are now believed seriously considering new refineries.

British American Oil Co., Ltd., this year may firm up plans for a plant on the Pacific Coast near Vancouver. Shell Oil Co. of Canada, Ltd., also is considering a new refinery.

The smaller, independent refiner represents a vigorous group in Canada. This sector of the industry maintains a high level of processing ability and is sharing in new construction from coast to coast.

Octanes in Canada generally have lagged behind those south of the border. But the upsurge in new catalytic capacity, plus the rising tenor of competition from newcomers, indicates that Canadian refiners will maintain octanes comparable with those in the U. S., if not higher.

Canadian Refining Capacity

(Barrels per stream day)

	1-1-55	1-1-56	1-1-57	Est. 1-1-58
Crude, B.P.C.D.	.....	.....	691,650	752,805
Crude, B.P.S.D.	608,740	680,645	747,250	814,900
Per cent annual increase	6.8	11.8	9.8	9.0
Thermal cracking	172,134	167,970	139,325	141,625
Per cent of crude	28.3	24.7	18.6	17.4
Cat cracking	211,550	324,550	337,200	350,000
Per cent of crude	34.7	47.6	45.1	43.0
Cat reforming	12,030	48,800	61,505	124,905
Per cent of crude	2.0	7.2	8.2	15.3
Polymerization	19,424	17,805	22,707	23,437
Per cent of crude	3.2	2.6	3.0	2.9
Hydrogen treating	666	7,397	19,025	61,425
Per cent of crude	.....	1.1	2.5	7.5

U.O.P. Sale Closer

● Independents opposing deal reach an agreement with A.C.S., Guaranty

NEW YORK.—The major obstacle blocking sale of Universal Oil Products Co. is in the process of being removed.

An agreement which will alter conditions of the sale is expected to be reached this week. It was drawn up to meet objections of the Independent Refiners Association of America and the 13 independent refiners who opposed the sale on grounds that it would put them out of business.

The agreement is expected to be signed March 29. It was reached between the independents on the one hand, and the American Chemical Society and the Guaranty Trust Co. on the other. The two major conditions of the agreement are:

. . . Ownership of the company will be spread among a number of stockholders, with no single company in a dominant position.

. . . U.O.P. services now available to licensors will be continued.

Negotiations pointing to the settlement have been under way for months. They were undertaken after the independents asked for and received permission to appear at hearings on the proposed sale.

Supreme Court Justice Jacob Markowitz in New York ruled in favor of the motion of the refiners to intervene. No court or government agency was involved in negotiations on the new agreement, however.

Companies which opposed the sale were Aurora Gasoline Co., Eastern States Petroleum Co., Elk Refining Co., Frontier Refining Co., Great Northern Oil Co., Ingram Oil & Refining Co., Kendall Refining Co., National Cooperative Refining Association, Pennzoil Division of the South Penn Oil Co., Quaker State Oil Refining Co., Rock Island Refining Corp., United Refining Co., and Vickers Petroleum Co., Inc.

Other snags . . . New York's Atty. Gen. Jacob K. Javits has opposed the sale on grounds that the 10 per cent commission asked by Guaranty Trust, which is handling details of the sale, is exorbitant.

A petition filed by Filtrol Corp. also attacked Guaranty Trust in connection with the sale. The petition asked the New York Supreme Court to take the sale out of the hands of Guaranty. It charged that the trust company may by extending information on U.O.P. to a banking firm.

Why the Rush Offshore?

U.S. Steel tells what's behind the gulf's accelerated activity and predicts a 780,000-bbl. output in 10 years

SHREVEPORT.—If you think drilling in the Gulf of Mexico is already a big-league operation, just look 10 years down the road.

That's what U. S. Steel Corp. has done, and here's what it sees for the 1966-1970 period:

. . . **Completion of 1,200 wells** a year, compared with an estimated 570 this year.

. . . **Production of 780,000 bbl.** a day. This would be 8 per cent of the nation's output then. In 1955 production in the gulf was only about 80,000 bbl., or 1 per cent of the U. S. total.

. . . **Tubular-goods needs averaging** 370,000 tons a year. This will be 10 per cent of all oil-country tubular-goods production. By comparison 1955 offshore operations required only 86,000 tons, or 3 per cent of the national output.

This forecast of a tremendous growth in offshore activity was presented here last week by Henry J. Wallace, vice president of U. S. Steel's National Tube Division at the spring meeting of the southern district of the American Petroleum Institute's Division of Production.

Why the rush? . . . Wallace cited five major factors which will accelerate the Gulf of Mexico drilling campaign:

. . . **Rental clauses in leasing** contracts. The high rental cost makes it imperative that companies find out quickly the value of their leases.

. . . **Need for return on investment.** The tremendous sums spent in offshore exploration must be offset by income from the properties.

. . . **Committed investment.** The money already spent on leases, equipment, and other facilities precludes any long deferment of drilling programs.

. . . **Need to develop gas.** A major gas outlet can't be built until drilling has proven reserves sufficient to meet Federal Power Commission requirements.

. . . **Middle East threats.** The Suez crisis and the continuing threat to the availability of Middle East oil has heightened interest in Western Hemisphere drilling.

At the same time, Wallace said there are five other factors which will tend to limit activity. These, he said, are:

. . . **The feud between the states** and the federal Government over ownership of the offshore lands.

. . . **Shortages of structural steel** and plates and of facilities to make some equipment.

. . . **Tight money** and the increased cost of financing programs.

. . . **Lower allowables** in the gulf resulting from imports and other factors.

. . . **Shortage of qualified personnel.** This is a problem only in certain areas.

Why the optimism? . . . The outlook for the gulf is "extremely favorable," the U. S. Steel forecast says, "despite high costs, the constant risk of severe storms, and the dispute between Louisiana and the federal Government.

"The area off the coasts of Louisiana and Texas is the greatest single source of crude and gas remaining in this country, and it is essential for the future of the domestic petroleum industry to explore and develop the 17,000,000-acre reserve on the Continental Shelf."

U. S. Steel estimated the gulf reserves at 12 billion barrels of crude and 70 trillion cubic feet of gas.

Pipeline prediction . . . Wallace said U. S. Steel looks for pipeline construction to hit a peak in the gulf during the 1961-1965 period.

Line-pipe demand for the gulf is estimated at 75,000 tons a year through 1960, 100,000 tons during the next 5 years, and 90,000 tons a year through 1970. During the last period, principal demand is expected to be for small-diameter pipe for gathering systems.

Sun Steps Up Multigrade Drive

PHILADELPHIA.—April will see the first superpremium fuel marketed from Sun Oil Co. stations outside the Florida test area.

For the time being, the company will offer motorists two grades, the basic Blue Sunoco 200 which corresponds to the traditional single grade, and the 240 grade which is competitive with other superpremium fuels.

Eventually, when pump changeover is complete, the company will be selling five grades: 200, 210, 220, 230, and 250. Meanwhile, its second grade, available until the new blending pumps are installed, will be midway between 230 and 250.

This will presumably rate at around 100 octane or better, since the 250 grade is understood to comprise almost 100 per cent of the Sunoco octane concentrate, which rates better than 104 Weise numbers.

Market proved . . . Sun has expressed its complete confidence in the public's acceptance of the multigrade concept. Before officially abandoning the single-grade policy, which it has followed for 30 years, Sun did some intensive market research.

Buying habits of over 100,000 motorists were studied. Then, 30,000 were interviewed at Sun stations and at their homes. Sun reports they overwhelmingly favored the new system.

When the Florida experiment got under way, Sun had a play on the top 250 grade. This indicated a good many curiosity buyers. As the trial progressed, sales of this top grade tapered off, but gallonage of lower blends increased. Sun expected this and was not disappointed, since a relatively small percentage of cars now on the road require the top grade.

Market researchers noted another factor they consider significant. There was a sharp increase in business from the so-called critical cars, those with top octane requirements.

The car owners had been instructed to use superpremium fuels and they came to Sun in increasing numbers after the company installed blending pumps for the five grades.

New tankage and, eventually, new pumps are going into all 21 states where Sun now markets. This area includes New England, the East Coast, and central states as far west as Illinois and Kentucky. The company also has its eyes on urban Chicago. It has already reached the outskirts of the city.

Canada, too . . . Sun's Canadian subsidiary is not far behind in multigrade plans. Many stations north of the border are now putting in the dual fuel-handling facilities necessary for both the interim two-grade system and the ultimate five-grade range.

The big advertising kickoff in the U. S. comes this week, and the program will be continued to introduce the new system throughout Sun's marketing territory.

The 10,000 specially-made blending pumps Sun ordered recently will equip all of the company's 800-odd stations in the 21-state marketing area.

Gas-Liquid Reserves Outstrip Crude

- **Oil finders actually had good year in 1956 but their net gains were cut sharply by tremendous production**
- **Geologists also say new cycle of discovery starting last year won't show up in reserves for 2 years yet**

Frank J. Gardner
Exploration Editor

THE oil and gas industry scored fairly well in 1956, according to reserve figures released last week by the American Petroleum Institute and American Gas Association.

At first glance, it would appear that 1956 was a pretty bad year for crude-oil finding and an excellent year for natural gas and associated liquids. A study of the figures, however, reveals that it was actually a fairly good year for all three.

For the first time since records have been kept, the net gain in natural-gas liquid reserves (463.8 million barrels) exceeded the net gain in crude-oil reserves (422.5 million barrels). Natural gas reserves soared to 237.8 trillion cubic feet to rack up the largest net gain so far recorded by the A.G.A. (14.1 trillion cubic feet).

Actually, more crude oil was found in 1956 than in any year since 1953. Proved reserves added by the committee for 1956 amounted to 2.97 billion barrels. This is 104 million more than was found in 1954 or 1955.

As for natural-gas liquids, 809.8 million barrels was found to top all previous years. This means that a total of 3.78 billion barrels of liquid hydrocarbons was uncovered by the nation's oil finders in 1956, approaching the 1953 figure of 4 billion barrels.

So U. S. oil finders did a fair job last year. The thing that makes the figures look a little depressing on first glance is production.

More crude oil was produced during 1956 than in any year on record; 2.55 billion barrels flowed from the nation's wells, leaving a net gain in crude reserves of only 422.5 million barrels. More natural-gas liquids were produced than in any year on record—346 million barrels. But the tremendous success in gas liquid discovery left a net gain here of 463.8 million barrels, which exceeded the gain in crude.

Why '56 was important . . . This is the lowest net gain in crude-oil reserves so far on record. To the casual observer, such a small addition would seem to imply that the U. S. will not be able to produce enough oil by 1965 to meet domestic demand.

But the important and encouraging factor lies in the minds of the nation's geologists. They feel that in 1956 a new cycle of discovery got under way and that actually they may have found more new crude than at any time since 1952.

This success, however, will not be reflected in the reserve figures for another year or two, after additional drilling proves up the reserves now existing only in unofficial records of the nation's oil finders. The A.P.I. figures do not include oil under the unproved portions of partly developed fields, oil that may become available through new secondary-recovery projects, etc.

Newly discovered fields are rarely developed in the first year to a point where any reasonable estimate of reserves can be accurately made. Therefore, the estimated half-billion barrels that geologists think they found in the Paradox basin in 1956 may not be actually on record for several years.

How records were set . . . All reserve figures were sent to new record highs during 1956 in spite of record production in all categories. Crude reserves as of January 1, 1957, were 30.4 billion barrels; natural-gas liquids stood at 5.9 billion; and natural-gas reserves were 237.8 trillion cubic feet.

As in previous years, most of the new supply came from "extensions and revisions" rather than from new field discoveries. This of course will continue in years to come and if the oil finder was as successful in 1956 as he thinks he was, the revisions and extensions increment in 1957 and 1958 should show even greater growth. And it may well be that the curve on net gain in crude oil will show a substantial upward projection.

Standing by states . . . The biggest net increase in crude reserves during 1956 occurred in Louisiana, where new re-

Proved Reserves of Crude Oil

(Thousands of barrels)

	Proved reserves as of 1-1-56	Extensions and revisions	New disc.*	Production during 1956	Proved reserves as of 1-1-57	Changes in reserves during 1956
Alabama	20,604	19,897	.....	2,964	37,537	16,933
Arkansas	329,539	12,089	3,947	27,849	317,726	—11,813
California†	3,801,408	301,800	18,903	350,754	3,771,357	—30,051
Colorado	334,003	82,965	5,202	58,420	363,750	29,747
Illinois	691,161	77,878	13,003	82,042	700,000	8,839
Indiana	61,458	17,589	956	12,275	67,728	6,270
Kansas	998,068	97,206	21,496	124,559	992,211	—5,857
Kentucky	107,454	55,068	3,448	17,528	148,442	40,988
Louisiana†	3,255,287	574,741	115,387	269,996	3,675,419	420,132
Michigan	58,889	7,094	75	10,746	55,312	—3,577
Mississippi	387,702	13,822	5,731	39,050	368,205	—19,497
Montana	298,948	46,387	7,800	21,721	331,414	32,466
Nebraska	57,697	14,294	7,720	16,850	62,861	5,164
New Mexico	819,658	81,745	21,150	87,116	835,437	15,779
New York	42,943	.....	.....	2,747	40,196	—2,747
North Dakota	185,532	11,947	11,110	12,755	195,834	10,302
Ohio	56,000	12,498	.....	4,923	63,575	7,575
Oklahoma	2,016,045	175,697	29,867	211,811	2,009,798	—6,247
Pennsylvania	93,344	49,587	.....	8,231	134,700	41,356
Texas†	14,933,502	762,934	164,488	1,077,785	14,783,139	—150,363
Utah	37,112	283	26,550	2,510	61,435	24,323
West Virginia	47,000	3,320	3,138	2,237	51,221	4,221
Wyoming	1,373,630	88,621	7,251	106,338	1,363,164	—10,466
Miscellaneous‡	5,186	—348	.....	650	4,188	—998
Total U. S.	30,012,170	2,507,114	467,222	2,551,857	30,434,649	422,479

*Only a limited area is assigned to each new discovery. The concern is only with actually proved reserves. †Includes offshore reserves. ‡Includes Arizona, Florida, Missouri, Nevada, South Dakota, Tennessee, and Virginia.

Proved Recoverable Reserves of Natural Gas

(Millions of cubic feet—14.65 psia. at 60° F.)

	Reserves as of 1-1-56*	Extensions and revisions*	Discoveries*	Net change in underground storage†	Net prod.‡	Reserves as of 1-1-57*
Arkansas	1,164,367	2,990	38,457	—551	33,736	1,171,527
California§	8,892,950	258,495	76,317	11,264	487,793	8,751,233
Colorado	2,253,562	187,523	73,161	3,291	94,768	2,422,769
Illinois	233,565	2,574	1,395	7,180	25,009	219,705
Indiana	33,111	4,289	0	477	4,105	33,772
Kansas	16,293,080	1,652,569	195,316	3,042	577,750	17,566,257
Kentucky	1,262,270	46,051	7,600	1,681	72,000	1,245,602
Louisiana§	42,435,592	2,910,172	1,630,589	0	1,922,354	45,053,999
Michigan	325,874	4,562	15,377	27,995	12,022	361,786
Mississippi	2,608,340	—29,648	43,592	1,273	220,231	2,403,326
Montana	719,719	6,094	718	438	30,618	696,351
Nebraska	203,421	39,174	8,182	0	25,375	225,402
New Mexico	18,584,912	5,222,559	340,232	—33,116	641,880	23,472,707
New York	75,760	5,127	1,420	6,877	3,935	85,249
North Dakota	280,696	112,270	20,512	0	15,985	397,493
Ohio	809,874	39,845	6,390	29,225	31,727	853,607
Oklahoma	13,204,739	1,249,397	234,480	3,035	916,602	13,775,049
Pennsylvania	754,389	97,573	9,915	32,751	118,416	776,212
Texas§	108,287,548	6,944,630	2,829,100	2,423	5,334,951	112,728,750
Utah	420,896	170,461	46,949	0	18,520	619,786
Virginia	34,756	2,813	937	0	2,949	35,557
West Virginia	1,564,899	121,564	25,250	32,995	182,971	1,561,737
Wyoming	3,196,103	152,232	16,932	—199	129,136	3,235,932
Miscellaneous¶	57,022	11,288	13,655	3,889	5,093	80,761
Total U. S.	223,697,445	19,214,604	5,636,476	133,970	10,907,926	237,774,569

*Excludes gas loss due to natural-gas liquids recovery. †The net difference between gas stored in and gas withdrawn from underground reservoirs, inclusive of adjustments and native gas transferred from other reserve categories. ‡Net production equals gross withdrawals less gas injected into producing reservoirs. Changes in underground storage and gas loss due to natural-gas liquids recovery are excluded. Fourth quarter production estimated in some instances. §Includes offshore reserves. ¶Includes Alabama, Arizona, Florida, Iowa, Maryland, Missouri, and Nevada.

Proved Reserves of Natural Gas Liquids

(Includes condensate, natural gasoline and liquefied petroleum gases.)
(Thousands of barrels)

	Proved reserves as of 1-1-56	Extensions and revisions	New disc.*	Production during 1956	Proved reserves as of 1-1-57	Changes in reserves during 1956
Arkansas	45,124	338	18	3,013	42,467	—2,657
California†	324,941	16,548	663	30,424	311,728	—13,213
Colorado	12,511	—129	.....	837	11,545	—966
Illinois	18,457	464	92	2,241	16,772	—1,685
Indiana	132	17	5	21	133	1
Kansas	173,236	2,111	1,944	5,676	171,615	—1,621
Kentucky	8,675	291	145	1,860	7,251	—1,424
Louisiana†	935,950	98,628	23,589	43,225	1,014,942	78,992
Michigan	872	178	134	116	1,068	196
Mississippi	57,876	—215	1,421	3,079	56,003	—1,873
Montana	6,857	1,550	.....	262	8,145	1,288
Nebraska	6,436	436	183	551	6,504	68
New Mexico	342,207	84,574	2,489	15,171	414,099	71,892
Ohio	1,557	120	13	21	1,669	112
Oklahoma	354,354	26,131	5,963	30,860	355,588	1,234
Pennsylvania	3,024	178	89	124	3,167	143
Texas†	3,045,361	476,364	57,037	198,873	3,379,889	334,528
Utah	108	—8	.....	5	95	—13
West Virginia	30,526	761	253	4,799	26,741	—3,785
Wyoming	50,348	7,420	.....	3,894	53,874	3,526
Miscellaneous‡	20,013	7	18	1,001	19,037	—976
Total U. S.	5,438,565	715,764	94,056	346,053	5,902,332	463,767

*Only a limited area is assigned to each new discovery. The concern is only with actually proved reserves. †Includes offshore reserves. ‡Includes Alabama, Florida and North Dakota.

serves exceeded production by 420.1 million barrels.

Strangely enough, Pennsylvania was second with a net increase of 41.4 million, and Kentucky was third with a net gain of 41 million. Obviously, these latter two states have received some new study and extensive revision by the A.P.I. reserves committee.

Montana added 32.5 million barrels net; Colorado, 29.7, and Utah (scene of the nation's greatest boom at present) only 24.3 million barrels.

As for natural-gas increases, New Mexico showed the best net gain with 5 trillion cubic feet; Texas was second with 4.4, and Louisiana was third with 2.6.

The great gain in natural-gas liquids occurred in Texas, where 334.5 million barrels was added; in Louisiana with 79 million, and in New Mexico with 72 million. This is nearly triple Texas' record for 1955, one and one-half times the 1955 record for Louisiana, and more than 32 times as much in New Mexico.

For the first time, the nation's reserves of total hydrocarbon liquids has reached 36.3 billion barrels, an increase of 886 million over 1955. While the net gain is relatively small compared to the 1948-1951 period, it is the second best gain during the last 5 years. But it still is not enough.

If a favorable reserve picture is to be maintained in the U. S., at least 4 billion barrels of new crude must be found every year. This is not being done, but geologists believe the new-reserve curve will now turn upward once more.

Tidelands Bids Due April 16

HERMOSA BEACH, Calif. — Oil companies have until April 16 to submit bids for exploratory drilling in the tidelands of this small Santa Monica Bay city.

The city council paved the way for this action by adopting a set of rules to which bidders must agree before contracts are awarded. Wells must be slant-drilled from a city-owned lot ¼ mile from the beach. Contracts call for a minimum 18 per cent sliding-scale royalty plus cash bonus.

Successful bidder must pay all expenses for an election to nullify a 1929 city ordinance against drilling within the city limits. The city also reserves the right to shut down drilling immediately in case of subsidence.

Independents and several major oil companies asked the city to throw open the tidelands to drilling.

Pembina Gears for New Lease on Life

● With 1,770,000,000 bbl. of secondary oil at stake, Alberta Government gives companies until April 1 to file secondary-recovery plans. The giant Canadian field may take the pressure-maintenance title away from East Texas.

CALGARY.—Prospects are that Alberta's tremendous Pembina field late this year or next year will displace venerable East Texas field as the world's biggest pressure-maintenance operation.

The Alberta Petroleum and Natural Gas Conservation Board is now cracking down in a drive to achieve field-wide pressure maintenance. It has no time to lose. Pembina generally is fast losing valuable bottom-hole pressure. It'll be too late 2 years from now to do anything about the problem.

One full-scale warm water-flood project is already under way. Several pilot floods have been approved. But operators in the field who haven't already launched water or gas-injection projects now must file plans to do so with the board by April 1.

The set up . . . Pembina won't be 4 years old until this coming July. But it already sprawls over a staggering 347,200 acres or 542 sq. miles. And it still isn't fully defined!

The huge field right now is contesting West Texas' Spraberry Trend Area field as the biggest oil pool on the North American Continent. It dwarfs East Texas which once boasted 135,000 acres but is now down to slightly over 100,000.

Pembina's Cardium pay, like the Spraberry, is a big undersaturated sand body of the strat-trap type. It feathers out in all directions into impermeable shaly sand and shale. The 1,692 wells at Pembina produce nearly 125,000 bbl. per day.

The discovery well was drilled in July 1953 by Socony, now Mobil Oil of Canada, Ltd. The intense development campaign since then has proved that Pembina, following the Spraberry pattern, is a solution-gas reservoir. And engineering studies show that primary recovery from the Cardium will be very poor.

Operators and the conservation board became alarmed in 1955 when 2-year-old wells in the developed parts of the field began showing disturbing drops in pressure and climbs in gas-oil ratios. Some were even unable to make their allowables.

Long-term outlook . . . The future for Pembina looked black until mid-1956. Then cheering news came in the form of an exhaustive reservoir study holding that the Cardium could be water-flooded very profitably.

The study was made by James A. Lewis Engineering, Inc., Dallas, for a group of operators headed by Canadian Seaboard Oil Co. Canadian Seaboard, one of the early operators in the field, had become convinced in 1955 that something had to be done to increase recovery. It persuaded its partners—Bailey Selburn Oil & Gas, Ltd., Honolulu Oil Corp., Merrill Petroleums, Ltd., Canadian Petrofina, and Great Plains Development Co. of Canada, Ltd.—to hire the Lewis firm for a survey *(The Oil and Gas Journal, June 11, 1956, page 80)*.

The survey covered 16,920 acres owned by the Seaboard group in the Buck Creek, Wolf Creek, and Buck Lake areas of the field.

Lewis, a recognized authority on secondary recovery, found that three blocks (A, B, and C on map) totaling 11,200 acres in the Buck Creek and Wolf Creek areas were good water-flood prospects.

The remaining 5,760 acres in the Buck Lake region was not recommended for a flood but for possible gas injection later.

His study confirmed that the primary take from Buck Creek-Wolf Creek acreage would be low, only 32,624,000 bbl. of oil and 69,448,000 M.c.f. of gas. Total oil in place was set at 248,127,000 bbl. This meant a recovery of only about 13 per cent—and death for the area in about 15 years.

Board convinced . . . The Seaboard group could more than triple this take, however, to 107,034,000 bbl. of oil and 52,341,000 M.c.f. of gas by flooding with warm water, Lewis found.

The water flood would produce the total estimated primary reserve in only 4½ years. It also would add 22 years to the area's producing life.

But the flood would have to be launched quickly. Lewis said the opportunity to flood would exist for only 2 years. Pressure after that time in the area would have declined too far.

The study's double-barreled finding that flooding was feasible but only for a short time fired the conservation board into action.

It promptly approved the Canadian Seaboard group's request to put the Lewis plan for a full-scale flood into operation on its acreage immediately.

It also approved pilot-scale floods in other portions of the field by Mobil Oil of Canada, The Texas Co., and Pan American Petroleum Corp.

The conservation board has been applying increasing pressure since on other acreage holders to join the parade—especially in those areas of the field where development is well advanced. Operators such as Texaco, with its big, sparsely developed block in the far northwest end of the field, likely will be given more time. Pressure in such areas isn't being pulled down so fast.

The board capped its drive for field-wide pressure maintenance with its ultimatum to operators for filing such plans by April 1.

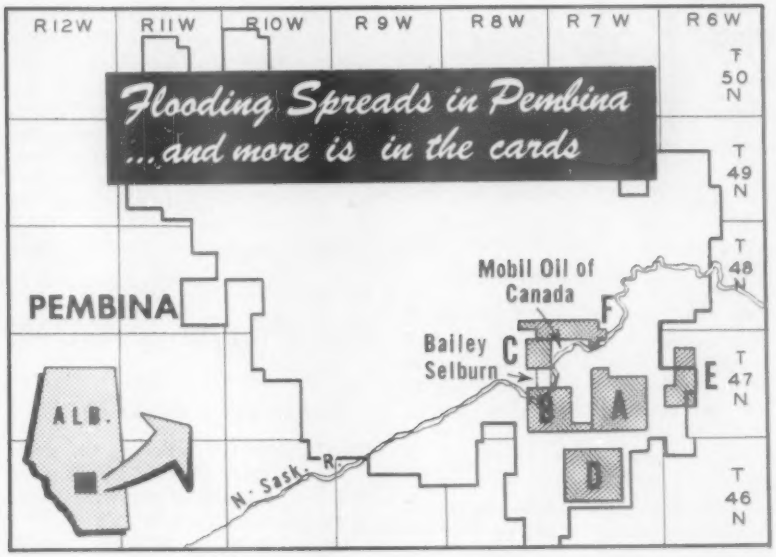
The hot-water flood . . . The Canadian Seaboard group has let no grass grow under its feet.

With the permit in hand, it kicked off a crash program last summer to get its flood under way as close to the first of this year as possible. It achieved the goal despite having to do most of the work during the severe Canadian winter.

Contract was let to Brown & Root, Ltd., covering construction of pumping plants and meter stations and burying and wrapping lines for the project.

Six injection plants with a total capacity for injecting 36,000 bbl. daily of warm water have been completed. Fifty miles of ditch were dug. About 420,000 ft. of 2 and 3-in. injection and return lines and 40,000 ft. of 4 and 6-in. water supply lines were laid.

Half of the 176 producing wells have been converted to injection service. And 77 of these are now taking a total of about 11,000 bbl. of water daily. Spacing in the area is one well per



80 acres. Injection is on a 320-acre five-spot pattern.

Eight good water wells are furnishing injection water from 40 to 400-ft. sands.

Canadian Seaboard hopes to have the program fully developed by midsummer. It started injecting water in one area last November. Others have been included as facilities were completed.

Project expanded . . . Since the board permit was received, operators controlling another 3,500 acres have joined the project. And another 2,240-acre block (Block E on map) likely will come in soon.

The biggest chunk of added acreage (2,240 acres) is Block F (see map), owned by Canadian Seaboard, Honolulu, and Merrill. Seaboard again is operator.

The flood plan initially called for only five pumping plants. Inclusion of Block F forced addition of the sixth in that block. The plant in Block C is furnishing water to two other new additions—a section held by Bailey Selburn to the south and a half section held by Mobil Oil to the east.

Half sections have been added to Blocks A and B.

When the entire project is fully developed this summer, nearly 36,000 bbl. of water daily will be going into the Cardium. This is near capacity of the pumping plants.

And flooding operators have found that the present shallow-sand source won't give up that much water. Canadian Seaboard likely will lay more supply lines to tap the North Saskatchewan River which flows through the area. Later floods will probably use river water, too.

Seaboard has built up input well pressure slowly, starting from gravity flow in some instances. Input rates at most of the injection wells now in service range from 150 to 360 bbl. daily at input pressures ranging from 0 to 900 psi.

This summer Seaboard hopes to be injecting water as fast as the Cardium will take it. The maximum is thought to be about 360 bbl. per day per well. Input pressure then will run at about 1,800 to 2,000 psi.

Warm water, a new angle . . . Operator interest in the Seaboard group's flood is snowballing throughout the U. S. and Canada.

Only part of this is chalked up to the project's large size and what it may mean for giant Pembina.

Chief interest is centering around the warm water used and how the operator is heating water and keeping it warm in Canada.

Lewis had two good reasons for recommending warm water:

. . . Heat made water less viscous, permit more to be injected, and thus hike ultimate recovery over a cold-water flood by about 5 million barrels.

. . . Heat also kept water from freezing. In fact, water had to be heated if used at all. Otherwise the operation would freeze up in the frigid Alberta winters.

As it was, three lines froze last winter. The cause was necessity of laying water in ditches containing snow, ice, and frozen dirt. This will be avoided in the future.

Injection water is warmed at each of the six pump stations and rewarmed at the meter stations.

Lewis engineers figured that flood water should enter the Cardium pay at 129° F.—which is the temperature of the reservoir.

They devised this system to do it:

. . . Supply water (produced at 50°) is heated to 100° at each station in two 1,000-bbl. galvanized tanks by twin 4,000,000-B.t.u. direct-type heaters in the tanks.

. . . It cools on the way to the meter stations and is reheated by water-bath heaters there.

. . . It cools again on the way to the input well but is rewarmed to the desired temperature as it goes down the well bore.

Pumping capacity of the six stations ranges from 2,000 to 8,000 bbl. daily. All have single-cylinder Ajax DP 115 (115 hp.) engines driving National F-90 triplex pumps.

Each station has two anthrafilt-type pressure filters. These are installed between the two 1,000-bbl. tanks, making it easy to backwash the filters. One tank contains filtered, the other unfiltered, water.

The Seaboard group has space at each station to add units to pump another 2,000 bbl. daily each if more water is needed.

The Buck Creek-Wolf Creek project takes in a lot of acres, but it will take 24 more projects of this size to cover Pembina.

The future . . . Lewis technicians think on the basis of last year's study that most of the giant field's Cardium pay is suitable for either water or gas injection.

Permeability and porosity of the Cardium vary greatly from top to bottom of the pay and from area to area. And because of this Pembina experts can only make an educated guess at secondary reserves.

They think, though, that the Cardium in the large area studied by the Lewis group is fairly representative. Roughly 3 out of every 4 acres in the area was deemed floodable.

This yardstick indicates that about 265,000 acres of the field could be flooded to recover a staggering 1,770,000,000 bbl. of added oil.

And on top of this must be added secondary oil which will be taken from at least part of the rest of the field (some 87,000 acres) thought feasible for gas injection.

These are big figures. But early reserve estimates in such cases in the past generally have proved ultraconservative. These for Pembina may be, too.

Emergency Line Boosted

Flemming says American's proposed East Coast oil line is "very desirable," but this doesn't mean it will be built

WASHINGTON. — The long-discussed Gulf-East Coast emergency oil line received the blessing of Mobilization Director Arthur S. Flemming as he retired from government service last week.

The line is "very desirable" from the standpoint of the defense program, he said. But Flemming's decision to support the proposal does not mean that it will be built.

The line, designed to carry 500,000 bbl. daily of products in peacetime and crude in an emergency, is proposed by American Pipeline Corp. The company will be given a certificate of essentiality if it can meet fiscal policies set by the Treasury and get materials.

American will immediately set about shaping its program to the Government's requirements, Paul Ryan, chairman of the firm, said.

American originally proposed a products line to run from the Gulf Coast to the Ohio-Pittsburgh area. It was granted quick tax writeoff several years ago but could not qualify for a certificate of essentiality. Recently it expanded the project to run from Beaumont, Tex., to Newark, N. J., meeting the Government's objective of getting a through line.

Texas Eastern conversion . . . A competing proposal by Texas Eastern Transmission Corp. based on conversion of the Little and Big Inch gas lines was turned down by Flemming. The cost to the Government to back substitute gas lines would be more than the American project, he said.

Flemming's recommendation has nothing to do with Texas Eastern's privately financed plan, now before the Federal Power Commission, to convert the Little Inch to products. The plan involved was submitted by Texas Eastern 2½ years ago at the request of ODM.

FPC in 1955 authorized retirement of the Little Inch from gas service and conversion to products, and its position remains that "public convenience and necessity permit the retirement of the Little Inch . . ." and construction of gas lines to replace the lost capacity.

FPC has completed new hearings ordered by the U. S. Circuit Court of Appeals to consider effect of the conversion on barge operators and other competing interests. Approval is expected again, and Texas Eastern says it plans to start operation of the Beaumont-Moundsville, W. Va., line as a products system next fall.

Flemming's reasons . . . The idea of a Texas-New Jersey pipeline was first raised during the Korean war. But the need for it was sharply underlined by the Suez Canal closing and the cutting of the Iraq Petroleum Co. pipelines in Syria. Flemming gave a number of reasons for favoring the line.

. . . Normal commercial incentives do not necessarily result in a transportation set-up suited to wartime requirements.

. . . Use of oil on the East Coast would continue in wartime, affected only by possible losses of consuming facilities and increases in special wartime demands.

. . . World War II showed that coastwise shipping cannot be depended upon against submarine attack.

. . . There is considerable capacity for moving oil by pipeline in the East. That capacity could be increased in an emergency. But just how much capacity there is, and what might be done with it, is a military secret.

Esso Digs Storage

Million-barrel project to handle Baton Rouge product

BATON ROUGE.—Esso Standard Oil Co. is nearing completion of underground cavities for storing more than 1,000,000 bbl. of product from the company's 343,000-bbl. Baton Rouge refinery.

The storage project is on a 100-acre tract near Sorrento, about 35 miles south of Baton Rouge. Three of five cavities are completed. They will store butane, propane, ethylene, and propylene.

Facilities will also include a 1,100,000-bbl. brine pit. When product is removed from the top of a cavity, brine from the pit is injected into the bottom of the cavity. This keeps the storage area full of liquid at all times. Brine is used because fresh water would enlarge the cavity through leaching.

The cavities are being formed by drilling holes into the solid rock salt and then dissolving the salt at the bottom of the wells. The top of the salt dome is more than 2,000 ft. below the surface of the ground. The cavities range in size from 150,000 bbl. to 300,000 bbl.

Interstate Oil Pipe Line Co. of Shreveport is laying 154 miles of pipe to connect the salt-dome area with the refinery. The pipeline system will consist of two 4-in. lines, one 6-in. line and one 8-in. line, all laid in a single trench. It should be completed in about 2 months.

No Change at ODM

New director will follow Flemming policies on oil

WASHINGTON.—Policies laid down by former Mobilization Director Arthur S. Flemming will be followed by his successor, Gordon Gray.

There will be no wholesale reversal of Flemming's policies on oil, Gray told a news conference last week. He took over his post as head of the ODM with no preconceived ideas, he said.

Where situations change it may be necessary to change direction, Gray said.

The new ODM chief is spending his first days in the ODM studying the agency's many problems. He will probably not reach any decisions immediately, but one of the first questions facing him will be that of oil imports.

Company reports on import programs after the Suez Canal is reopened were due to be filed with the ODM by the end of last week. After the figures are totaled, Flemming said the Government would decide whether planned imports would have to be revised.

It will be up to Gray to decide whether to ask the companies to cut their imports, under penalty of action under the national security clause of the Trade Agreements Act.

Socony Plans Nuclear Lab

PRINCETON, N. J.—Socony Mobil Oil Co., Inc., has purchased a 315-acre site near here for a nuclear research center. The new unit will operate as a subdivision of Socony's research and development laboratory at Paulsboro, N. J.

It will include a 2,000,000-electron-volt Van de Graaff accelerator, a hot laboratory equipped for use of fission-waste radioisotopes, and irradiated cobalt 60.

Also installed will be "counting" laboratories for assaying radioactive materials and full safety facilities to protect staff members.

The lab will have use of the nuclear

reactor which will be located 5 miles away at Plainsboro, N. J. This reactor is to be built and operated by Industrial Reactor Laboratories, Inc., in which Socony, with 10 other industrial firms, has an interest.

Strike Vote Slated

New union action involves four West Coast refineries

WILMINGTON, Calif. — This key area in oil's labor picture may take the center ring this week in labor-management's circus-like round of 1957 activity.

Local 128 of the Oil, Chemical, and Atomic Workers Union was scheduled to meet to decide whether to call for a strike vote against four major refineries in this area.

Richfield Oil Corp., Shell Oil Co., The Texas Co., and Union Oil Co. have been negotiating with the union for several months. At stake for the union is the big O.C.A.W. demand for a 27-cent hourly wage increase.

Meanwhile, Standard Oil Co. of California and the Independent Union of Petroleum Workers will resume contract negotiations this week. The I.U.P.W. wants a 28-cent hourly increase consisting of a 10½-cent productivity element, a 10-cent cost-of-living increase, and a 7½-cent company contribution to a hospital medical plan.

Gulf Coast contract . . . Some 5,000 workers at The Texas Co.'s Port Arthur refinery have won a year's contract providing an additional paid holiday and other fringe benefits.

Local 4-23 of the O.C.A.W. had been negotiating with the company since last September. Wages were not involved in these negotiations.

The new holiday—Good Friday—is the eighth paid holiday granted Texaco workers. A similar concession was made recently to workers at the Standard Oil Co. (Ind.) Whiting refinery.

The new Texaco agreement also provides more liberal pension and insurance benefits. The bargaining group includes about 5,000 of the 7,000 Texaco employes at Port Arthur.

This contract came shortly after Indiana Standard reached an agreement with the 6,300 members of the Independent Petroleum Workers of America at Whiting, Ind. *(The Oil and Gas Journal, March 18, page 85).*

I.P.W.A. accepted a 4 per cent increase (about 10½-cents per hour), which fell far short of O.C.A.W.'s 27-cent demand, and the Federation of Independent Oil Union's 25-cent demand.

watching WASHINGTON

. . . with Bertram F. Linz

A look-in at trade-ins . . .

THE already long list of congressional oil probes is about to be stretched further.

The House merchant marine committee is launching an investigation of the Government's programs to spur tanker building. It will bear heavily on the trade-in and trade-out policies of the Maritime Administration. The plan to build up a reserve fleet of tankers and dry-cargo vessels also will come in for study.

We have no real reserve of tankers today, it is charged by Rep. Herbert C. Bonner of North Carolina, chairman of the committee. And many of the vessels being transferred to foreign flags are better than ships in the reserve fleet, he says. These facts suggest a possible conflict of policy on the objective of an adequate, well-balanced merchant fleet, he believes.

The ship inquiry is the sixth laid out by Congress in a period of little more than 2 months.

Already under way are studies of the European oil lift by the O'Mahoney subcommittee and the Harris commerce committee. The fight to override the good-faith defense in pricing is before the Kefauver judiciary subcommittee. The House armed services committee is studying plans to resume research on oil from shale. A House small business subcommittee is about to look into the relations between major companies and their service-station operators.

Don't count on Suez yet . . .

GOVERNMENT sanction for the pooling of tankers to move oil to Europe expires this week. But all signs point to an extension of the program under which Europe is now getting more than 90 per cent of her oil needs.

Ending of the oil lift hangs on the reopening of the Suez Canal. That means more than just the clearing of the waterway. It means also a satisfactory arrangement for the payment of tolls. Egypt demands that they be paid direct. England and France want them put into an international fund for later distribution. This is one of the political questions of which officials have warned in the past.

The major producing states already have been told that the oil lift will have to continue next month at its present rate. The notice went out from the ODM as one of the last acts of retiring Director Flemming. A Bureau of Mines estimate that demand for domestic crude would drop 600,000 bbl. daily in April, it is explained, was based on the assumption that both the canal and the Iraq pipeline would be working.

Reopening of the pipeline will ease the pressure. But it won't end the need for U. S. oil in Europe.

No rest for the weary . . .

IT looks as if the Federal Power Commission will be swamped with a backlog of gas-producer cases for some time to come. An economy-minded House appropriations committee refused last week to go along with FPC spending ideas.

The committee cut the FPC's budget for the coming fiscal year by $370,000. The $5,530,000 allowed is $305,000 more than the commission has for this year. But it's still not enough to permit FPC to hire the additional help Chairman Jerome K. Kuykendall said is badly needed.

The additional money is for retirement costs, the committee pointed out. It said the effect will be that FPC will have to continue at its present size. Kuykendall has estimated it will take the commission, without the extra help, about 3 years to clear up cases now before it.

The FPC this year has $2,363,500 for natural-gas regulation. It asked $2,751,900 for the coming year, and estimated that something over $1,000,000 would be needed for producer regulation.

Crude Outlet Proposed

● 10,000-bbl. line would move Oklahoma, Kansas crude pushed from the market by increased production in Texas

WICHITA.—West Central Texas isn't the only producing area needing an outlet for its crude. The same problem has cropped up in southwestern Kansas and northwestern Oklahoma.

In an effort to provide an outlet for Kansas crude, Southern Kansas Pipeline, Inc., has been organized to build a 200-mile line to move 10,000 bbl. daily of distressed crude. This crude will be without a market by the end of this week.

The project is being promoted by Aladdin Petroleum Corp., one of the producers whose crude has been purchased by Shamrock Oil & Gas Corp. Shamrock will stop taking the oil April 1 because its own pipeline connections in the Texas Panhandle exceed the market demand. Higher Texas allowables and new production are the reasons.

G. H. Bruce, president of Aladdin, filed a request with the Kansas Corporation Commission for a permit to build a line from southwestern Meade County to a point in Cowley County, some 10 miles north of Arkansas City, Kans.

The line, to be 6 to 10-in. in diameter, would have 10,000 bbl. daily capacity at first. But Bruce says there was more production available in the area. He said a market for about half the crude had already been contracted and the rest should be lined up in a few days.

The line would cross half a dozen pipelines. Most of the crude would be bought by Oklahoma and Kansas refiners. The rest would be taken to Chicago.

Bruce sought an early hearing on the proposal in order to relieve the distress situation as soon as possible. He expressed hope the project could be pushed through this year, perhaps within 6 months. Even if it is built, producers face several months of trucking their crude to markets 100 to 200 miles distant, such as the Arapahoe pipeline or Arkansas City. And the haul would cut 50 cents to more than $1 a barrel from the price paid the producer at the wellhead.

Some crude will have to be trucked to the Southern Kansas Pipeline if it is built. Except for pools near the western terminal in Meade and Clark counties, the production is so scattered it does not warrant building a gathering system.

Other possibilities . . . Another possible solution is a pipeline to the Schurr station of Arapahoe pipeline, about 100 miles northeast of the distress area.

Shamrock, which is shutting off 150 bbl. daily of its own Kansas production, asked Pure Transportation Co., operator of Arapahoe, to make a feasibility study. Reserves are now being checked, along with samples of the crude to see whether it would raise any batching problems in Arapahoe.

A pipeline spokesman, who sees great potential for the three corners area of Colorado, Kansas, and Oklahoma, said present reserves would justify a 10 to 12-in. line to Arapahoe. Arapahoe has been approached about building a line, but so far no decision has been made. It could handle perhaps 12,000 bbl. daily east of Schurr station, but that would be pressing capacity to the 135,000-bbl. limit.

Whether this alternative proves to be the solution depends on Arapahoe shippers' inclination and ability to find a market for the crude.

How situation developed . . . Oklahoma and Kansas producers in the area have been selling their crude to Groendyke Petroleum, Inc., which trucks it to Shamrock's line at Turpin in the Oklahoma Panhandle.

But the market has been declining rapidly since October. Shamrock was buying some 60 per cent of the allowable in February and 40 per cent this month. C. A. Cash, Shamrock vice president, said his firm has been buying up to 33,000 bbl. per day from connected wells and has a market for only 16,000 bbl. at its McKee refinery.

The balance has been delivered to Phillips and Humble pipelines, but they no longer have any space available.

"We have talked to anybody who would even listen about taking the crude, but without success," Cash said.

Shamrock had to pull out of Oklahoma and Kansas for two reasons:

. . . Higher Texas allowables for its connected wells because of the Suez Canal shutdown.

. . . Increasing production in the Texas Panhandle, particularly in Ochiltree, Hansford, and Hutchinson. Production in Ochiltree and Hansford alone increased from 1,500 to 10,000 bbl. daily the past year. And that figure, Shamrock estimates, could double by the end of 1957, the way development has been progressing.

Marlex 50 Now Going to Market

HOUSTON.—First large-scale quantities of Marlex 50 started moving this month from Phillips Chemical Co.'s big Adams Terminal plant on the Houston Ship Channel.

Phasing-in of the operations started in December, but commercial production of the petrochemical has been just a trickle until now. Other units are still going on stream. They will bring capacity to 75 million pounds a year during the last half of 1957.

The revolutionary, pure-white plastic resin was developed by the parent Phillips Petroleum Co. Phillips claims it has greater rigidity and strength, high resistance to temperature extremes, and greater durability in chemical or abrasive applications. It will become the base for a wide range of plastic articles.

Domestic price of Marlex 50 has been set at 47 cents a pound, delivered, in shipments of 20,000 lb. or more.

New products coming . . . Marlex 50 is the only product now being produced at the plant, but new members of the Marlex family are scheduled to make their debut there soon. One of these is said to be even tougher than the tough Marlex 50, and another will supplant Marlex 50 in uses where greater flexibility is required.

Marlex 20, an original member of the Marlex family, won't be among the new commercial products, however. It has been replaced by Marlex 50, with which it once received equal billing.

When Phillips came up with the new Marlex group, it also came up with a new, low-pressure, low-cost, catalytic process for making it.

While competing polyethylene processes operate at pressures of 15,000 to 30,000 psi., Phillips turns out its Marlex group with a mere 500 psi. in an operation that requires a far less expensive initial layout.

Those are a couple of reasons the industry has been watching both the product and the process ever since they were announced. Another reason is the performance of Marlex 50. Tests show it doesn't become brittle at temperatures as low as 175° F. below zero. And it won't go soft or deform at steam sterilization temperatures as high as 250° F.

Ethylene source . . . Phillips is now getting raw material for the plant from an outside source, but will later switch to

its own plant now under construction at Sweeny, Tex., about 75 miles away.

The plant, located adjacent to the Phillips refinery, will turn out 180 million pounds of ethylene a year at the start. The product will move to the Marlex plant through a pipeline that has already been laid. The ethylene plant is scheduled for completion by midsummer.

Treasury Won't Talk

But depletion brings word of caution from Humphrey

WASHINGTON.—Treasury officials refused last week to give Congress their views as to whether 27½ per cent is the right rate for oil and gas depletion.

But Secretary George Humphrey warned the Senate finance committee not to tinker with the rate without first making a thorough study of the effect of a cut on exploration.

"If you stop looking for oil in this country we would never catch up," Humphrey said. "Just what the depletion rate should be is something that you should decide."

The question of reducing the depletion allowance for oil and gas has popped up in Congress annually for a number of years. Sen. John J. Williams of Delaware has a bill to reduce it to 15 per cent. But Williams complained that he has been trying for 4 years to get the Treasury's reaction to his bill, without success.

"I am still not prepared to tell you," Humphrey retorted.

"I am not undertaking to justify it. But if you want to consider this issue I think it would be very desirable to make a thorough study to determine whether or not our general national purpose is being achieved," Humphrey added.

L.P.G. Chalks Up a New First

DEMOPOLIS, Ala.—The nation's first L.P.G. storage in chalk formation is ready to take its second dose of propane and butane.

Tuloma Gas Products Co. and Sinclair Oil & Gas Co., Tulsa, have completed the second of two cavities mined out of Selma chalk 3 miles west of here in Marengo County. The project holds 15 million gallons of L.P.G.

The floor is 315 ft. below surface. Two 7-ton bulldozers were lowered in pieces through a 42-in. shaft, and then reassembled on the cavity floor. The dozers left staggered pillars of 35 ft. in diameter to hold the roof.

Utah Land Disputed

Aneth oil play kindles old federal-state controversy

SALT LAKE CITY.—Utah Atty. Gen. E. R. Callister plans court action to settle a federal-state land dispute in oil-rich southeastern Utah.

Discovery of oil in the Aneth field brought the controversy to a head, but the foundation was laid in 1919. At that time the legislature enacted a state law to require retention of mineral rights on land originally given to the state when Utah was admitted to the union.

Later, the Navajo Indian Reservation was set up. It now includes a number of sections of such land which the state traded to the federal Government for public domain land elsewhere in Utah.

The exchange agreement failed to pin point the 1919 law, reserving mineral rights for the state.

The Utah Land Department recently has been granting mineral development leases on land involved in the Navajo Reservation exchange. The federal Government also has granted similar leases to identical tracts of land.

Producing wells have been drilled around but not on the approximately 2,700 acres involved in the dispute. The Utah attorney general wants to clear up the matter before someone does strike oil on one of the disputed sections.

Refinery Planned

West German firm looking for site in San Diego area

LOS ANGELES.—Cal-Mex Oil & Refining Co., a subdivision of Vereninigte Petroleum Werke of West Germany, is shopping for a refinery site in San Diego County.

The company has let a $27-million design, engineering, and construction contract to Ralph M. Parsons Co. of Los Angeles for a 20,000-bbl. plant. The site will probably be in the South Bay area of the city of San Diego. This, however, hinges on availability of water, according to Cal-Mex officials.

Construction is scheduled to start within a year, with the tentative completion date early in 1959. Processes will include a cat cracker, cat desulfurizer, cat reformer, and sulfur-recovery unit. The plant will turn out 100-octane gasoline, jet fuels, and Bunker C.

Cal-Mex plans to import its crude. It would be unloaded at an offshore marine terminal and moved to shore through a marine line.

Pipeline briefs

The Texas Co. has started laying a 10-in. crude-gathering system in its area of Aneth field in southeastern Utah. Contract has been let to Ted Price Construction Co., Electra, Tex., to lay some 60 miles of gathering lines, a pump station, and discharge line for loading trucks which will handle crude until the Four Corners pipeline is built to Los Angeles. The system will be completed in 30 days. More than 19 tons of dynamite has been used to clear right-of-way and in ditching for the system, which traverses a rocky, hilly region.

Transcontinental Gas Pipe Line Corp. has let contract to Western Construction Co., Austin, Tex., for 110 miles of 30 and 36-in. loops along its system in South Carolina, North Carolina, Pennsylvania, and Virginia. Western plans to start the last of May in North Carolina, working out of Winston-Salem. The contractor will lay 65 miles of 36-in. and 45 miles of 30-in. at scattered spots along the route.

Natural Gas Pipeline Co. of America has started work on its 350-mile, 20 and 26-in. line from Jack and Wise counties, North Texas, through southern Oklahoma to Fritch, in the Texas Panhandle. The 20-in. Red River crossing was let to R. H. Fulton & Co. and the main-line construction is to be awarded this week.

Canadian pipelines delivered an average of 750,000 bbl. of crude oil per day in 1956, for a total of 274,000,000 bbl. Trans Mountain delivered 47,200,000 bbl., up 18.1 per cent; Interprovincial 97,100,000 bbl., up 20.3 per cent; Montreal pipeline 76,700,000 bbl., up 13.4 per cent; Pembina 33,600,000 bbl., up 134 per cent; and Imperial's gathering lines 54,000,000 bbl., up 1.8 per cent.

Also for Pipeliners . . .

Pipeliners are preparing for the big Railroad Commission hearing scheduled April 1 (P. 101) . . . Flemming backs American's proposal for East Coast line, but Texas Eastern's proposals far from dead (P. 112) . . . Crude line proposed to relieve producers in northwestern Oklahoma and southwestern Kansas (P. 114) . . . New welding method is developed by H. C. Price Co. (P. 116) . . . Aramco's tax schedules outlined for Senate probers (P. 117) . . . Big Middle East companies meet to discuss new crude lines (P. 117) . . . Pipeline Patrol (P. 228).

BIG 34-IN. PIPE on Trans-Canada line is welded outside, left photo, and inside, above, with a mechanized submerged-arc welding method developed by H. C. Price Co.

Trans-Canada expedited as . . .

New Method Speeds Welding

OAK RIVER, Man.—The first application of a new mechanized submerged-arc welding method is speeding construction on a 99-mile section of Trans-Canada Pipe Lines, Ltd.

The method, developed by H. C. Price Co., Bartlesville, Okla., is being used for double jointing on a 34-in. spread contracted to Price - Poole of Canada, Ltd.

Welding has been carried on without difficulty at 40° below zero, and welds have stood up under the most vigorous tests. They are completed in 7 minutes by Price mechanized welding as compared with more than an hour manually.

How it works . . . Paul Reed, the Journal's pipeline editor, who visited the operation early this month, reports:

. . . The key is the first simple step: Special grinding of pipe ends to produce a $\frac{1}{16}$-in. land instead of the usual $\frac{1}{8}$-in. land. So the beveled area is smaller.

. . . Two submerged-arc beads are run on the outside of the pipe and one bead on the inside. This is the first time a pipeline has been welded inside.

. . . The only manual welding is tacking of the pipe ends with a stringer bead for a distance of only 2 to 2½-in. while pipe is held in position by internal lineup clamp.

The welding head doesn't move. The pipe is rotated on rubber-coated rollers on the first rack while the sealer bead and cap bead are run and the lineup clamp is removed. Then it goes to a second rack where it is rotated while the back-up bead is run inside the pipe. For running this inside bead, the operator rides into the pipe on a gantry boom carrying the submerged-arc welding head.

The welding heads are identical for outside and inside welds. These heads are Lincolnweld ML-2 adapted for "semi-full" automatic submerged-arc welding.

Since the arc is submerged in this type of welding, it is much safer. There is no need for welders to wear protective hoods or even goggles.

The new welding procedure was developed by Barney Elliott with the collaboration of Don Barchus, both of H. C. Price Co.

Double jointing yards . . . The procedure is being applied at yards to join pairs of 40-ft. joints to form 80-ft. joints.

Nearly half of the welding for the Price-Poole section on the Alberta-Winnipeg leg of the gas line is done before stringing pipe on the right-of-way. This technique, permitting more joints of pipe to be laid in a single day, can speed progress of a spread.

The Price welding and double-jointing-yard equipment is unusually portable. Three 600 - amp. motor - driven welding generator sets and a 75-kw. diesel generator are housed in a mobile trailer. The Cross-Curran power-operated, double joint racks for conveying and rotating the pipe can be dismantled readily and trucked to the next yard location.

A recent move from a yard site at Crandall, Man., to Oak River, a distance of some 25 miles, required only 8 hours.

—— *Processing briefs*

Kentucky's first U.O.P. Platforming and Unifining units are now on stream as a combination facility at the Louisville Refining Co.'s 7,000 bbl. refinery at Louisville. The installation has a capacity of 2,000 bbl.

Atlantic Refining Co. will build a 2,100-bbl. alkylation unit at its 62,000-bbl. Port Arthur refinery. It will operate in conjunction with a new 15,000-bbl. Catforming unit to make high-octane gasoline components for Atlantic's new superpremium motor fuel.

Du Pont's first tetraethyl lead plant west of the Rocky Mountains is now on production. The new Antioch plant —just northeast of Oakland, Calif.— uses a continuous process of manufacture, rather than the batch process. Du Pont has two other TEL plants, one at Deepwater Point, N. J., and the other at Beaumont.

Amoco Chemicals Co. has picked Joilet, Ill., as site for its new 60-million-pound aromatics oxidation plant. Mixed xylenes will be obtained from Whiting refinery of parent company, Standard Oil Co. (Ind.). The Joilet plant will make phthalic anhydride, isophthalic acid, terephthalic acid, dimethyl terephthalate, dimethyl isophthalate, and benzoic acid.

Construction is under way on a 1,000-bbl. U.O.P. Platformer at Sunland Refining Corp.'s 8,000-bbl. refinery at Bakersfield, Calif. Litwin Engineering Co. of Wichita, Kans., is doing the work. Completion is scheduled for July 1.

Also for Refiners . . .

Some of the industry's top executives outlined what their companies plan in 1957. What do they see: A 4.6 per cent increase in domestic demand (P. 99) . . . The U.S. and Canadian refining industries are geared for more capacity, higher quality, according to the Journal's annual refining survey (P. 102) . . . Independents agree to sale of U.O.P. (P. 106) . . . Sun widens its marketing of multigrade gasolines (P. 107) . . . Esso Standard is nearing completion of big L.P.G. cavern for Baton Rouge products (P. 112) . . . O.C.A.W. members plan strike vote in California (P. 113) . . . Phillips starts commercial production of Marlex 50 (P. 114) . . . German company plans California refinery (P. 116) . . . The Journal's Annual Refining Number starts on page 121.

Tax Probe Hits Aramco

Company chairman says revised tax edict in Saudi Arabia caused payments to U.S. to drop nearly $48 million a year

A TAX setup under which Saudi Arabia got nearly $281,000,000 from Arabian American Oil Co. last year and the U. S. Treasury got only $282,000 was eyed last week in Washington by Senate investigators.

Aramco's tax status, however, was only one of a number of angles of the Saudi Arabian operations probed by Sen. Joseph C. O'Mahoney of Wyoming.

The joint judiciary-interior subcommittee which he heads also dug into the return to the four companies which own Aramco, Aramco's prices, its depletion allowance and its place in the world-oil picture.

Repeatedly calling Saudi Arabia a "Bonanza," O'Mahoney charged that Aramco is "dividing up production and doing the things against which the anti-trust laws were devised."

The charge was denied by F. A. Davies, Aramco chairman. He asserted that the four companies which own Aramco are highly competitive, among themselves and with others.

Davies and James Terry Duce, executive vice president, were sharply questioned by the subcommittee on Aramco's relations with its owner companies.

Standard Oil Co. (N. J.) paid $76,500,000 for its 30 per cent share and Socony Mobil Oil Co. paid $25,500,000 for 10 per cent in 1947, Davies said. But O'Mahoney charged they got their money back from Aramco profits in little more than a year. Last year, he said, they got back more than their original investment.

"It must be obvious that they would have bought this stock on the New York Stock Exchange at almost any price to participate in the bonanza," O'Mahoney said.

Taxes reshuffled . . . Prior to 1950, the Saudi Arabian Government got only its royalty of four shillings gold per ton of production, about 21 cents per barrel, Davies said.

Then the government brought in an American tax expert to write a law that would result in its getting a 50-50 deal without putting a new burden on the company. The result was a tax edict under which Saudi Arabia gets half the company's net earnings in royalties, rental, and tax.

Aramco income-tax payments to the U. S. have dropped from $48,000,000 in 1949 to about a quarter-million a year, as a result of the tax edict, Davies said.

A tentative balance sheet prepared for the subcommittee showed that Aramco's gross earnings last year were $749,000,000. Its total expenses, including payments to Saudi Arabia, were $468,000,000. Its net earnings were $281,000,000.

Saudi Arabia's income consisted of $80,000,000 in royalties and rent, and over $199,000,000 in income taxes.

Aramco had a deduction of around $152,000,000 for depletion in figuring its U. S. taxes, Davies said.

"We take both the depletion allowance and the foreign tax credit," he explained. "These have been allowed under our tax laws for years and are entirely appropriate."

Treasury gets share . . . Davies insisted, however, that the U. S. Treasury gets revenue from the Aramco operation. He estimated it collects over $100,000,000 a year in taxes, first on the four owner companies' dividends from Aramco and then in income taxes on dividends paid to their stockholders.

The U. S. has been in a state of war or uneasy peace for the past 40 years, O'Mahoney said during the hearing. In that period, Congress has given the President powers which are used in a dictatorship.

Now, he said, "we have to find ways to restore the powers of Congress and fight the establishment of the cartel system. That is what is at the heart of this thing."

"The question of who has the power is between Congress and the executive branch of the Government," Duce replied.

O'Mahoney questioned Davies at length about the interchange of company information, barred under the revised foreign supply agreement, but permitted under the Middle East emergency arrangement.

Davies said that all Aramco figures are published and available. But Aramco did not get any figures on its owners' operations before the Middle East Emergency Committee was set up, he asserted.

Aramco owners . . . O'Mahoney pointed out that Standard Oil Co. (N. J.) is "the richest oil company in the world." Socony Mobil stands second, The Texas Co. fourth, and Standard Oil Co. (Calif.) fifth.

"We are expected to believe that these four big companies know nothing about each other's operations although they were partners in the biggest operation in the world?" he asked.

Big Firms Huddle on Middle East Line

THE world's eight biggest oil companies—five of them from the U. S.—sat around a table in London last week planning pipelines to funnel Middle East oil safely to the western world.

A spokesman for the group emphasized that the talks are "exploratory" and are not expected to reach "detailed conclusions" at this stage.

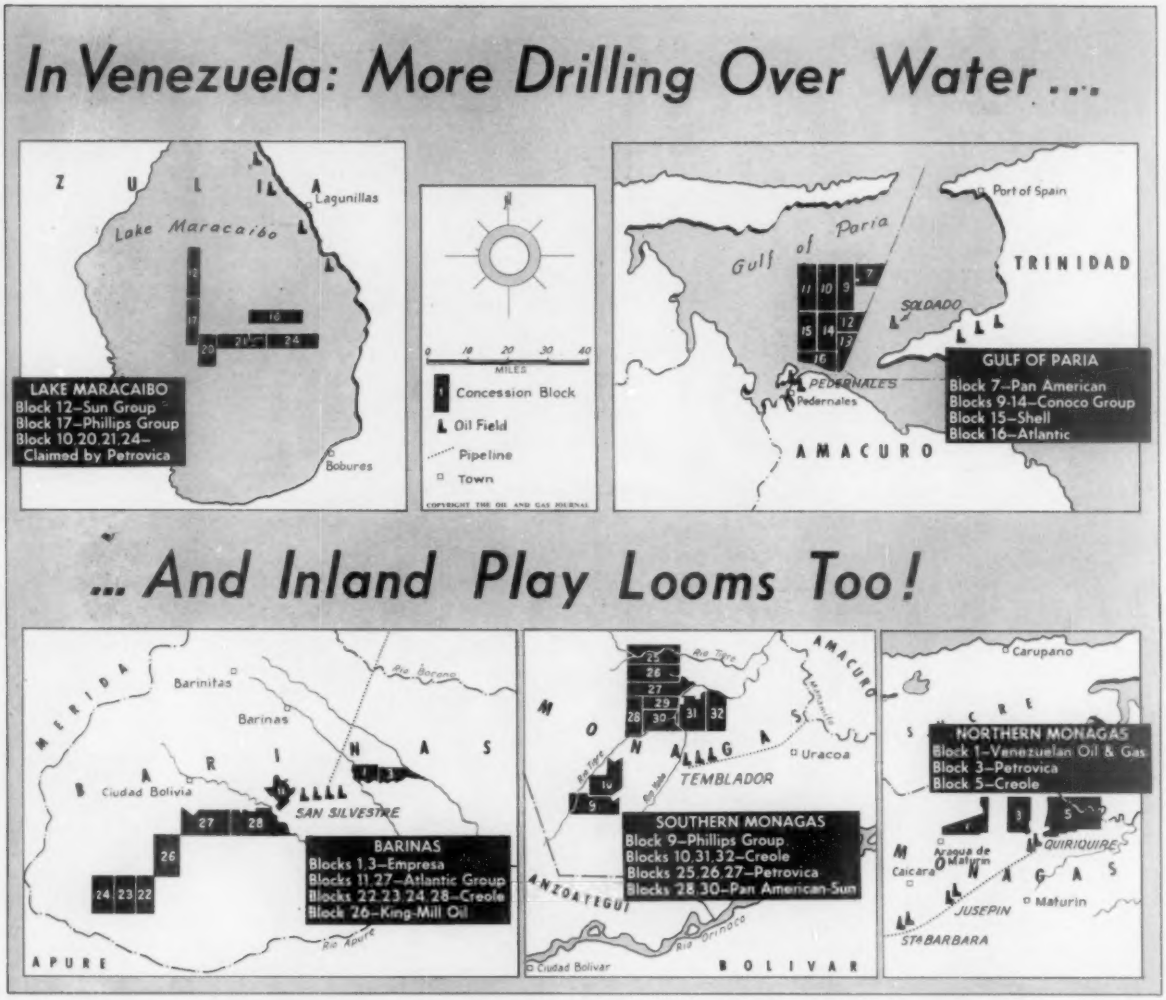
The meeting is the first concrete move toward removing supply bottlenecks for vital crude. The closure of the Suez and the blasting of Iraq Petroleum's pipelines across Syria has made more lines in secure locations essential. Several lines have been proposed.

The idea which has been most talked would mean a "superinch" line north from the Persian Gulf through Iraq and west to the Mediterranean through Turkey *(The Oil and Gas Journal, December 3, 1956, page 66).*

Since that time there has been discussion of a line to link the Mediterranean with the newly discovered oil in the Qum area of central Iran. This field discovery was spectacular, but is still far from proved.

Growing European demand . . . It is generally conceded that even a stable and completely usable Suez Canal is going to be hopelessly outdated if Europe's consumption of Middle East oil continues to grow as it has. The canal cannot handle tanker traffic heavy enough to meet the 1956 estimate of 4,700,000 bbl. daily for Europe alone.

Companies represented at the London talks are Standard Oil Co. (N.J.), Standard Oil Co. of California, Socony Mobil Oil Co., Gulf Oil Co., The Texas Co., Cie. Francaise de Petroles, The Royal Dutch-Shell Group, and British Petroleum Co., Ltd.



Big Bankrolls Ride on Venezuelan Grants

THE scores are far from all in, but it appears Venezuela is going to tuck away another $350 to $400 million in bonuses for new oil concessions.

Awards of the bids made last month are still dribbling out one and two at a time in Caracas in the government's Gazeta Oficial. Rumors about those not yet announced are flying thick and heavy.

Here are some of the more concrete trends that have emerged from the welter of fact and rumor:

... **It takes a lot of blue chips** to play for Venezuelan oil.

... **Only about 40 per cent of the tracts** offered by Venezuela found takers. High prices got the blame. Some companies who have waited for years for a shot at Venezuela found the price tags too high.

... **Total bonuses** will probably match or top the nearly $400 million bid last summer for Lake Maracaibo's semiproved acreage.

... **This healthy figure** will probably equal the minimum set by Venezuela in spite of the fact that 60 per cent of the lands went begging.

... **New faces bobbed up** all over the place. Some were entirely new companies formed in Venezuela. Others were United States companies new to Venezuela. Some were new combines of established companies and newcomers.

... **The Gulf of Paria** made its bid as a rival to Maracaibo and Barinas as the hot spot for new exploration in Venezuela.

Prices secret ... The Venezuelan Government quietly notified interested companies near the end of January that it was ready to accept bids on tracts in four areas of the country.

The Ministry of Mines and Hydrocarbons listed 89 separate blocks and specified minimum bids it would accept. The offering totalled almost 1,020,000 hectares (slightly more than 2,500,000 acres). Minimum bids for the entire lot nudged $390 million.

Official disclosure and well-founded speculation late last week indicated successful bidders have been tapped for about 402,000 hectares (a little more than 992,000 acres). What the companies paid in bonuses for these lands is still pure speculation. The Gazeta announcements named no figures. The companies themselves weren't talking prices. The bonuses are not expected to be disclosed until title to the concessions actually are granted.

Lake Maracaibo ... The scene of last summer's multimillion dollar scramble for concessions got a play once more.

The government offered six more 10,000-hectare blocks (24,000 acres) in the central part of the lake and specified a minimum bid of $728 an acre. Some new faces are among the apparent successful bidders.

Here are the latest reports on the bids:

. . . Block 12 went to a four-company combine composed of Pan American Petroleum Corp., Atlantic Refining Co., Sun Oil Co., and Seaboard Oil Co. Pan American and Atlantic each have a one-third interest; Sun 23⅓; and Seaboard the remaining 10 per cent.

. . . Block 17 went to a seven-company group headed by Phillips Petroleum Co. Others in the group are Kerr-McGee Oil Industries, Inc., El Paso Natural Gas Co., Western Natural Gas Co., Ashland Oil & Refining Co., Sunray Mid-Continent Oil Co., and Canadian Atlantic Oil Co., Ltd.

. . . Lot 10, already ill-fated because the successful bidder last summer failed to deposit the nearly $20 million bid, is apparently having similar trouble this time.

Reports from Caracas last week indicate that a Mexican-American combine bidding as Mexamer offered more than $1,820 an acre for Block 10, but failed to file the necessary letters of credit within 8 days of being notified.

Mexamer also offered more than $1,200 an acre or a total of $30 million each for Blocks 20, 21, and 24.

Officials of a new Venezuelan company, Petrolera Venezolano Internacional, C.A. (Petrovica), said in Caracas they have been awarded these four blocks in addition to several others in North and South Monagas. If this company fails to meet the financial requirements, it is assumed another bidder will be considered.

Gulf of Paria . . . With the two-well offshore success of Trinidad Northern Areas, Ltd., at Soldado field between Trinidad and Venezuela, the Gulf of Paria tracts were hotly contested and brought fancy prices.

Here are the apparent successful bidders there:

. . . Blocks 9, through 14, a total of 60,000 hectares (148,200 acres) went to a five-company combine headed by Continental Oil Co., which has a 25 per cent interest in the venture. The others are The Texas Co., 25 per cent; Ohio Oil Co., 25 per cent; and Cities Service and Richfield Oil sharing the remaining 25 per cent.

. . . Block 7, containing 9,000 hectares (22,230 acres) went to Pan American.

. . . Block 15, of 10,000 hectares (24,700 acres), went to Cie. Shell de Venezuela.

. . . Block 16, a tract of 6,000 hectares (14,820 acres) went to Atlantic.

Barinas . . . In Barinas, long considered the hot spot for new exploration in Venezuela, the government offered 28 separate tracts in an area where only two companies are now operating.

They totalled more than 900,000 acres, but in the early awards only nine of the tracts attracted bids.

Here they are:

. . . Blocks 1 and 3, a total of 23,500 hectares (a little over 58,000 acres), went to Empresa Nacional de Petroleo, a Venezuelan company.

. . . Block 11, of 10,800 hectares (26,676 acres), went to an Atlantic-Pan American-Sun combine.

. . . Block 26, of 20,000 hectares (49,400 acres), went to Kingmill Oil Co., not only a newcomer to Venezuela, but to the industry as well.

Kingmill is owned by a group of investors including Roger Millikan, a textile executive; Francis G. Kingsley, a director of Grace National Bank; Morton Downey; Gen. Richard C. Marshall; C. Newton Kidd, a banker; and Dr. Wendell Phillips.

. . . Block 27, of 22,000 hectares (54,300 acres), went to the Atlantic-Pan American-Sun combine.

. . . Blocks 22, 23, 24, and 28, a total of 80,000 hectares (almost 198,000 acres), went to Creole Petroleum Co., Venezuela's largest oil producer.

North Monagas . . . Only two of the seven tracts in the northern Monagas sector had takers in the early awards being discussed in Caracas.

All the tracts lie in the area north of the trend of producing fields which include Santa Barbara, Muri, Jusepin, and Quiriquire. They are:

. . . Block 5, of 29,500 hectares (almost 73,000 acres), went to Creole. The largest of any block in the area, it lies just to the northeast of Quiriquire.

. . . Block 1, of 12,000 hectares (29,640 acres), went to Petroleos y Gases Venezelanos, a Venezuelan company formed recently by Dr. Maximilian von Lowenthal and Louis Hart, Denver attorney.

South Monagas . . . Venezuela opened a total of 32 blocks in southern Monagas for bidding at a minimum figure of just over $145 an acre.

The cluster of 32 separate tracts lie on three sides of Temblador field. Only six of the 32 were mentioned in the initial awards:

. . . Blocks 9, of 10,000 hectares (24,700 acres), went to the Phillips combine.

. . . Blocks 10, 31, and 32, a total of 31,000 hectares (about 76,500 acres), went to Creole.

. . . Blocks 28 and 30, a total of 18,000 hectares (about 44,000 acres), went to a two-company combine with Pan American having a ⅔ interest and Sun the remaining ⅓.

Drilling plans . . . At least one operator reportedly is anxious to start drilling operations in one of the new areas within 60 days. But plans of others are based on a longer-term outlook.

Pan American, the producing and exploration affiliate of Indiana Standard, reportedly wants to start a test on its acreage in either Barinas or southern Monagas as soon as possible, maybe within 2 months. Pan American will be operator for the group winning Barinas Block 11 and southern Monagas Blocks 28 and 30. Atlantic will direct operations for Barinas Block 27.

Phillips will be operator for the big group in Lake Maracaibo Block 17 and southern Monagas Block 9.

Still undecided is operator for the group winning Gulf of Paria Blocks 9 through 14. In fact, companies operating in the Gulf of Paria face a big logistics problem. They must select land bases and assemble a vast array of marine and drilling equipment for offshore work. That will take time—and more money.

There are only a few idle rigs available among the 10 or so drilling contracting firms already in Venezuela. But an influx of more rigs and new contractors is expected to result when all the concessionaires start drilling.

Gulf Hits in Lake

Promising Maracaibo test adjacent to other acreage

GULF OIL CORP. has taken some of the wraps off its subsidiary's new discovery in Lake Maracaibo.

Details of Mene Grande Oil Co.'s Ceuta 1 remain undisclosed. But Gulf admitted the wildcat "discovered several hundred feet of Miocene and Eocene oil producing sections." The well is located off San Timoteo.

Gulf is optimistic about the outlook of the area. "This promising discovery is adjacent to some of the acreage acquired through new concessions in 1956, and makes the outlook for oil reserves in those properties very promising."

The discovery was made on a concession in Block V-575 obtained in 1944. Mene Grande's other concessions in the area are over Blocks V-574 and V-576. National reserve area is included in V-576.

The well first gained industry-wide attention when it blew out and caught

fire early in December. Total depth of the hole is 10,800 ft. Gulf has not disclosed depth of the productive zone, but local reports put it below 8,000 ft.

The Ceuta 2 offset is under way ⅓ mile southeast of the discovery. It is also on Block V-575 and is 7 miles southwest of San Timoteo on the eastern shore of Lake Maracaibo.

Venezuela Test Set

Combine to drill on lease awarded in lake last year

THE first Lake Maracaibo well to be drilled on the high-priced acreage that went on the block last summer will be spudded by a four-company combine in May.

A. A. (Duke) Curtice, well-known consultant, has been named the new president and general manager of Signal Exploration Co., which will drill the well. Curtice's company will act as operator for Signal Oil & Gas Co., Pure Oil Co., Hancock Oil Co., and Standard Oil Co. (Ohio).

A. A. CURTICE

The four companies paid a bonus of more than $31 million for the 27,600-acre block in Lake Maracaibo known as Lot 4. The tract is bounded on the north by Shell acreage and on the east and west by Creole acreage.

The platform for drilling the well has already been erected. The well will be drilled on contract by Loffland Brothers of Tulsa.

Garth L. Young, vice president of Signal Oil & Gas, who has been in charge of the Venezuelan operation, will continue to act as manager of operations through the end of this year, when he is expected to return to his company.

Heletz Adds Five Producers

Five more oil producers have been brought in at Israel's Heletz field where a 40-well drilling program may be achieved this year. One of the new wells contained 44 ft. of oil-saturated sands, by far the richest pay yet reported in the field.

These reports were made in New York by Hillel Dan of Tel Aviv and Kiel Federamann of Haifa, directors of Israel Oil Prospectors Corp., Ltd. The company operates the field jointly with Lapidoth Israel Petroleum Co., Ltd.

The visitors also reported 15 wildcat operations are planned in other areas of Israel this year. The test areas include the western shore of the Dead Sea, the Negev Desert, at Negba north of Heletz, and at Beeri just south of the field.

Ethiopia Deal Ends

Sinclair pulls out after poor exploratory results

SINCLAIR PETROLEUM CO. has given up its concession in Ethiopia.

The decision to pull out of the country came after negative results were obtained in a shallow and medium-depth drilling program. After this data was compared with geological, geophysical, and other data from two deep tests, prospects didn't stack up.

The Sinclair Oil Corp. subsidiary obtained the concession over the entire country in 1945. Work concentrated in the southeast after half the acreage was given up in 1951 under the agreement terms.

Somalia looks better . . . The company now feels that Somalia, to the east, may be a better bet. It holds half interest in Sinclair Somal Corp., which has a 92,000-sq.-mile concession *(The Oil and Gas Journal, March 19, 1956, page 134).*

The company currently is drilling its second test near the coast of East Africa. The wildcat is 60 miles northeast of the first test, drilled inland from Obbia.

The first test was abandoned at 12,764 ft. because of mechanical trouble. There were no shows but the well encountered a favorable section.

Continental Oil Co., Ohio Oil Co., and Amerada Petroleum Corp. equally divide the remaining half interest in the concession.

Tanker Rates Drop Sharply

Pressure on the free-world's tanker fleet is apparently easing off.

This is indicated by a sharp drop in spot-charter tanker rates in the past month and particularly the past 2 weeks. The rates are generally a good barometer of tanker availability.

In a comparison of typical voyages in mid-February and mid-March, U. S. Gulf-to-New York dropped from USMC plus 175 per cent to USMC plus 75 per cent for clean vessels. Netherlands West Indies-to-New York fell from USMC plus 200 to USMC plus 70. N. W. I. shipments to various European ports ranged from scale plus 160 to 175, compared with scale plus 295 to 315 earlier.

Persian Gulf to Japan fell from USMC plus 210 to USMC plus 70. Sidon to Italy, dirty, was off from scale plus 300 to scale plus 225.

Venezuela Well Hits

Offset to deep discovery flows 1,185 bbl. per day

VENEZUELAN ATLANTIC REFINING CO., and Pancoastal Petroleum Co., C.A., have dually completed their first test on eastern Venezuela's newest trend with a flow rate of 1,185 bbl. daily.

The Caro 1 is an offset to the Aguasay 3 discovery drilled by Venezuelan Petroleum Co. (Sinclair). It is located near the western edge of the 13,411-acre San Jose de Guanipa concession.

Perforations were made in a 12-ft. section from 13,403-15 ft. and in an 18-ft. section from 13,322-40 ft. The total flow of 1,185 bbl. daily came through ¼-in. chokes from each zone. Gravities varied from 30° to 35°.

An 18-ft. section lower in the well, 13,579-97 ft., produced 30.5°-gravity crude on test at the rate of 375 bbl. daily. This section was not completed, although it would have kicked the well's daily potential to 1,575 bbl. Total depth of well was 13,647 ft. and gas-oil ratio was 820:1.

Caro 2 is drilling ahead past 11,000 ft. Its projected depth is 13,500 ft. Location is directly north of Caro 1. A third well has been staked 1,300 ft. north of Caro 2.

The discovery . . . Caro 1 helps bear out indications that the new east-west trend may turn out to be one of the best developed in years in eastern Venezuela.

Aguasay 3 encountered more than 200 ft. of productive sands in several zones. One section tested in September produced 689 bbl. daily of 35°-gravity crude. The Sinclair company had equally good results on another zone checked in October.

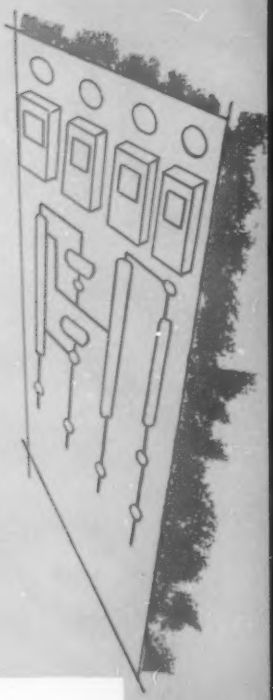
Since then, Sinclair has reported "good sand sections" in Aguasay 4, located 5 miles west. Mene Grande Oil Co. (Gulf), is now making tests on Zulus 1, another 5 miles west.

France Gets First Banias Oil

The first shipment of Iraqi crude loaded from a Mediterranean terminal since November has arrived at Sete, France.

Socony Mobil Oil Co., Inc.'s 27,600-ton tanker Aramis made the delivery. The ship was the first in line at Banias when the Iraq Petroleum Co., Ltd., pipeline system was partially reopened.

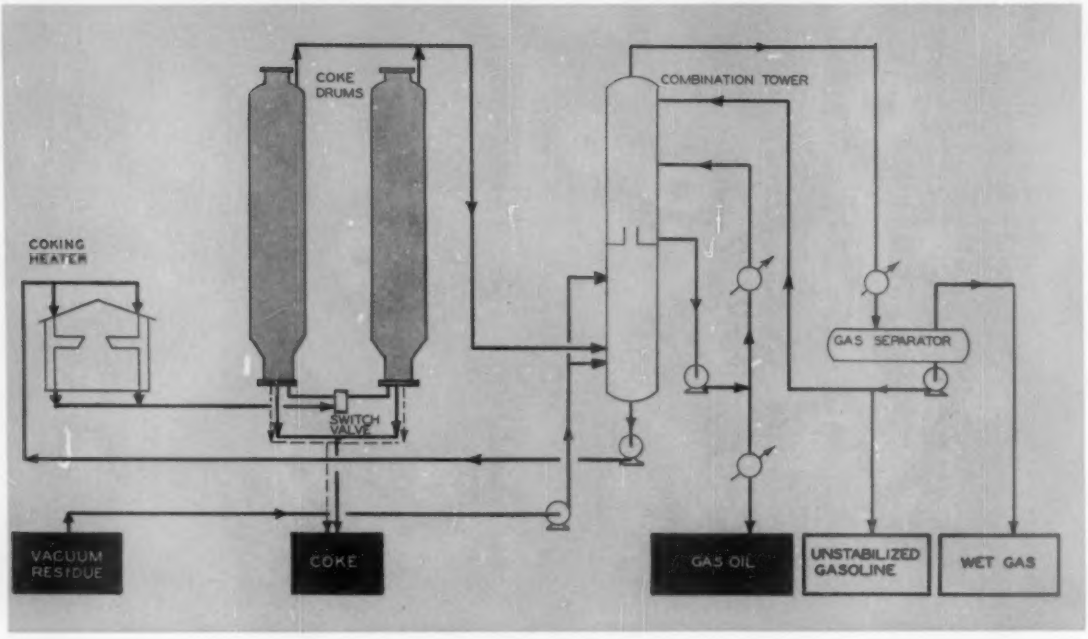
From Sete, the crude was sent a few miles further up the French Mediterranean Coast to the 29,000-bbl. Frontignan refinery.



48 Selected Plant Processes

Index to Processes Described . . .

Delayed Coking ... 122
Delayed Coking (Kellogg) ... 123
Fluid Coking ... 124
Solvent Decarbonizing ... 125
Thermofor Catalytic Cracking ... 126
Model IV Catalytic Cracking ... 127
Orthoflow Fluid Catalytic Cracking ... 128
Houdriflow ... 129
Fluid Catalytic Cracking (U.O.P.) ... 130
Two-Stage Fluid Catalytic Cracking ... 131
Houdresid ... 132
Furfural Refining ... 133
Powerforming ... 134
Catalytic Reforming (Sinclair) ... 135
Catforming ... 136
Ultraforming ... 137
Platforming ... 138
Rexforming ... 139
Houdriforming ... 140
Iso-Plus Houdriforming ... 141
Fluid Hydroforming ... 142
Cat Reforming and Desulfurization ... 143
Gulf HDS Process ... 144
Hydrofining ... 145
Hydrodesulfurization ... 146
Hydrogen Treating (Sinclair) ... 147
Unifining (U.O.P.) ... 148
Unifining (Union Oil Co.) ... 149
Vapor-Phase Hydrodesulfurization ... 150
Trickle Hydrodesulfurization ... 151
Diesulforming ... 152
Selective Diolefin Hydrogenation ... 152
Liquid-Phase Isomerization ... 153
N-Butane Catalytic Isomerization ... 154
Kellogg Isomerization (Iso-Kel) ... 155
U.O.P. Penex ... 156
Pentafining ... 157
Isomerate Process (Pure Oil) ... 158
Isomate Process ... 159
Sulfuric Acid Alkylation (Kellogg) ... 160
Effluent Refrigeration Alkylation ... 161
Alkylation—Effluent Treating ... 162
HF Alkylation (U.O.P.) ... 163
Perco HF Alkylation ... 164
Aluminum Chloride Alkylation ... 165
Polymerization ... 166
Phosphoric Acid Condensation ... 167
Urea Dewaxing ... 168



Delayed Coking

DELAYED COKING (Lummus) is an important refining step in the economics of processing heavy asphaltic crudes. The demand for distillate fuels continues to increase at a greater rate than that for residual fuels. When the present Middle East oil situation reverts to normal, it is estimated that within the next 10 years the demand for distillate fuels will increase 25 per cent while the demand for residual fuels will remain substantially the same as before the present crisis.

This situation, plus the fact that the average refinery charge will have a higher proportion of heavy-crude stocks, demands that more distillate stock, per barrel of crude, be produced in the future. Of additional importance is the need for electrode coke for use by the burgeoning aluminum industry, which requires approximately ¾ lb. of coke for each 1 lb. of aluminum produced. These factors combine to give added attractiveness to the installation of delayed-coking units.

New units . . . Industry's appreciation of the trend is attested by the delayed-coking units now being installed, and others being projected, in the general area of the Gulf Coast and eastern seaboard. Heretofore and presently (early 1957) this area has been able to satisfactorily dispose of all its heavy fuel oils, but may not, as a matter of fact, easily do so again after the Middle East crisis is settled.

Natural deposits (for example, gilsonite, shale oil, and sand oil) can be converted to usable light fuels by delayed coking plus catalytic hydrogenation. Furthermore, coke produced from these sources will have very low sulfur content, making it particularly well suited for electrode use, and perhaps giving added attractiveness to the exploitation of these sources.

Yields . . . The tables of yield and product specifications and the delayed-coker flow diagram illustrate an operation based on processing a heavy Tia Juana vacuum residue. A significant feature of this operation is the 41.6 volume per cent yield of excellent gas oil for catalytic cracking and 35.6 weight per cent yields of coke obtained from a residue with a 5 per cent boiling point of 1,015° F.

Lummus has developed a technique for successfully processing heavier vacuum bottoms than have heretofore been charged to a coker. Charge stocks, such as gilsonite and coal-tar pitch that would yield over 50 weight per cent coke, can also be processed.

Information on delayed coking may be obtained from Lummus Co., New York.

PRODUCT YIELD SUMMARY

	B/SD	A.P.I.	Lb./hr.	Weight (%)	Vol. (%)
Charge	9,660	7.7	143,120	100.0	100.0
Product:					
Wet gas			11,310	7.9	
Unstabilized gasoline	2,678	60.5	28,770	20.1	27.7
Gas oil	4,016		52,090	36.4	41.6
Coke			50,950	35.6	

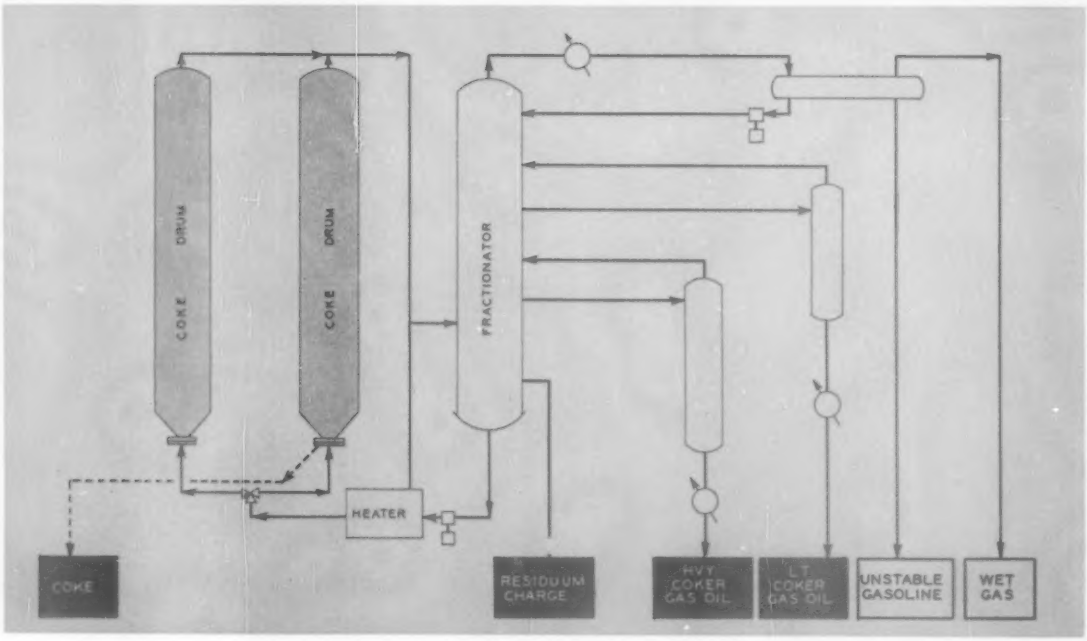
CHARGE AND PRODUCT SPECIFICATIONS

Charge Stock	
Gravity °A.P.I.	7.7
Vis. S.F.s. at 210° F.	1,200
Con. carb. wt. per cent	20.9
Dist. vac. corrected to 760 mm.:	
I.b.p., °F.	860
5 per cent	1,015

Debutanized Gasoline	
Gravity, °A.P.I.	56.8
R.v.p., psi.	4.0
Octane, clear	64.0
Dist. A.S.T.M., °F.:	
95 per cent	375
E.p.	400

Wet Gas (Mol. wt. = 30.7)	Mol. (%)
C_2, lighter	69.2
C_3's	16.2
C_4's	7.6
C_5+	6.0

Gas Oil	
Gravity, °A.P.I.	27.5
Con. carb. wt. per cent	0.10
Sulfur, wt. per cent	2.2
Dist. vac. corr'd to 760 mm.:	
I.b.p., °F.	410
E.p.	950



Delayed Coking

THE process converts heavy residuum oils into coke and more valuable light-hydrocarbon products.

Operation of a delayed coker differs from that of the usual thermal cracking process in that the charge stock, which is heated rapidly, flows to the coking drum where it is coked by its contained heat. The process is continuous. A transfer line manifold system utilizing a specially designed switch valve makes it possible to feed any drum without interrupting furnace operation. A delayed coker has the added flexibility to operate as a viscosity breaker of reduced crudes when fuel oil is in demand.

The charge can be reduced crudes either from atmospheric or vacuum flashing, asphalts, fuel oils from thermal cracking and heavy catalytic cycle oils.

The coker gasoline produced is a potential charge to catalytic reforming or as a product for gasoline blending. The coker gas oil is a clean (low-Conradson carbon) material suitable as charge stock for catalytic cracking or fuel-oil blending. The quality of coke produced is dependent on the charge stock; coke of low sulfur and metal content has a premium value.

Description . . . Residuum feed is charged to the base of the bubble-tower fractionator. The tower bottoms consisting of fresh feed plus recycle are rapidly heated in a furnace to temperatures of 900°-950° F. and discharged into insulated coke drums operating at 10 to 70-psig. pressure. The partly vaporized furnace effluent enters the drum and by a combination of residence time and temperature, coke is formed. Drum top temperature range is 800°-850° F.

The vapors leaving the coke drums are a wide-boiling mixture of gas, gasoline, gas oil, and heavy gas-oil recycle fractions, the result of cracking both in the furnace coil and in the drum. These vapors enter the lower section of the fractionator at which point the quantity of recycle condensed is controlled by the gas oil reflux to this section. The net vapors are separated into gas, gasoline, and gas oil.

To increase the thermal efficiency of the unit, it is general practice to split the gas oil into a light and heavy cut. The intermediate reflux system from the heavy gas oil drawoff provides charge preheat, steam generation or reboiler heat to gas recovery.

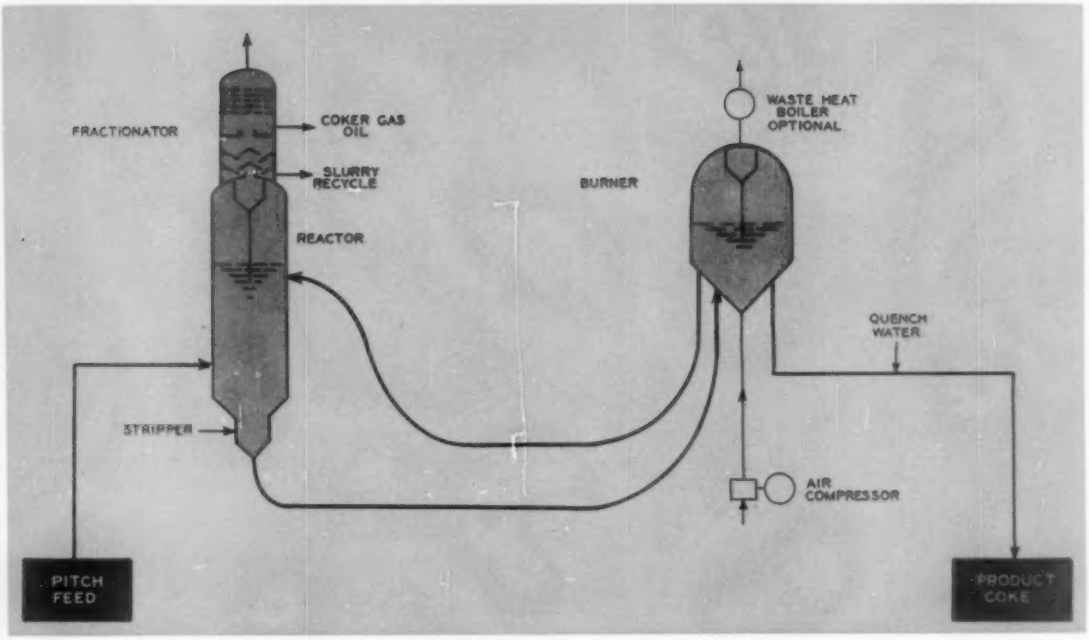
The actual number of coke drums required is determined by the feed rate and carbon forming characteristics of the charge stock. At any given time half of the drums are coking and the other half decoking. The usual coking cycle per drum is 48 hours, 24 hours coking and 24 hours decoking.

Coke accumulates in a drum to a controlled level, at which time the furnace effluent is switched to the adjacent heated drum.

Information on the process may be obtained from M. W. Kellogg Co., New York.

TYPICAL YIELDS

Reduced crude charge:	
Weight per cent	100
Gravity, °A.P.I.	15.7
Conradson carbon, per cent	10.8
Stabilized gasoline:	
Volume per cent	20.4
Gravity, °A.P.I.	58.4
Reid vapor pressure	8.0
C.F.R.M. octane number, clear	64.7
Gas oil:	
Volume per cent	61.1
Gravity, °A.P.I.	27.5
Conradson carbon, per cent	0.15
I.b.p., A.S.T.M., °F.	430
Dry gas, weight per cent	5.8
Coke:	
Weight per cent	22.3
V.C.M.	10.1
Ash, per cent	0.10



Fluid Coking

FLUID coking is a flexible, continuous process for upgrading a wide range of low-value residual stocks to gas oil, gasoline, and byproduct gas and coke. It was developed and is licensed by Esso Research & Engineering Co.

The process handles almost any feed stock that can be pumped. It will take atmospheric residua with initial boiling points as low as 600°-700° F., or vacuum residua with initial points close to 1,200° F. Feed stocks with gravities as low as minus 3.5° A.P.I. and heavier, or with Conradson carbons as high as 41 per cent, have been processed.

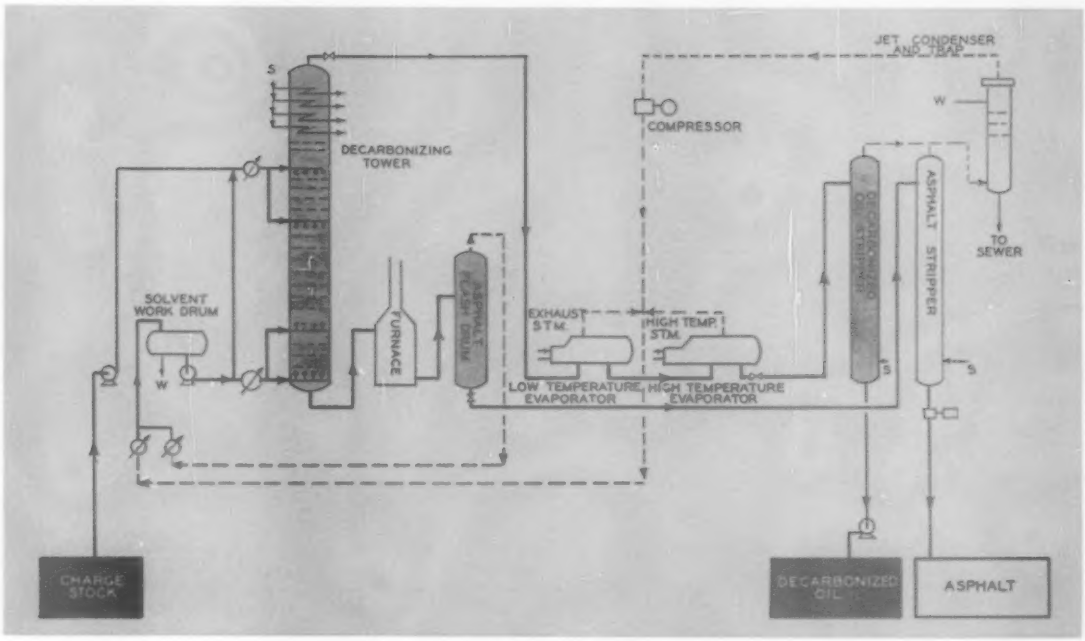
Yields . . . Total distillate yields vary from 50 to 90 volume per cent, based on coker feed. The naphtha fraction, after Hydrofining, can be fed to a catalytic reforming unit for conversion into high-octane motor fuels. The gas-oil fraction (430° to 1,015° F.) can be fed directly to a catalytic cracking unit to produce additional high-octane motor-fuel stocks.

Fluid coke is a new and potentially profitable byproduct. Currently, it is being used as a public utility fuel burned in conventional boilers. It has also been used successfully in the smelting industry, and has been found to have other metallurgical and specialty uses. The sandlike coke is comparatively dust-free, and can be handled and stored quite easily. It has a high fixed carbon content and low ash content.

Eight units with a combined feed capacity of 114,400 bbl. a day are in operation or under construction.

FLUID COKING YIELDS AND PRODUCT QUALITY

Crude source of feed—	Los Angeles Basin			Panhandle	West Texas	Hawkins	South Louisiana	
Feed to fluid coker—	Vacuum Pitch	Deasphalter Pitch	Visbreaker Tar	Vacuum Pitch	Vacuum Pitch	Vacuum Pitch	Vacuum Pitch	Atmospheric Residuum
Feed inspections:								
Gravity, °A.P.I.	6.7	—0.2	—3.5	17.3	8.4	4.2	11.6	17.7
Conradson carbon, wt. per cent	17	33	41	11	19	24	13	5
Sulfur, wt. per cent	2.1	2.3	2.1	0.7	3.5	4.3	0.6	0.5
Per cent distilled at 1,000° F.	25	0	5	0	10	10	5	40
Pour, °F.	120+	120+	120+	85	120+	120+	120+	100
Ultimate yields on coker feed:								
C_3 and lighter, wt. per cent	8	10	12	7	9	10	8	6
C_4, volume per cent	3	3	3	2	3	4	3	2
C_5/430° F., naphtha, vol. per cent	17	18	14	21	21	19	21	17
430/1,015° F. gas oil, vol. per cent	62	45	32	69	58	52	61	74
Coke, wt. per cent (gross)	21	36	48	12	20	27	17	8
Product quality:								
Naphtha (C_5/430):								
Gravity, °A.P.I.	55	54	55	59	56	56	56	56
Sulfur, wt. per cent	..	1.7	0.8	0.2	0.7	0.9	0.2	0.1
Research octane, clear	80	82	..	66	78	76	73	73
Gas oil (430/1,015° F.):								
Gravity, °A.P.I.	17	14	15	29	20	17	22	24
Sulfur, wt. per cent	1.7	2.2	1.7	0.4	2.6	3.4	0.5	0.4
Watson K factor	11.3	11.0	11.0	12.0	11.3	11.1	11.6	11.8



Solvent Decarbonizing

SOLVENT decarbonizing is a liquid-liquid extraction process which recovers the heavier paraffinic fractions untouched by vacuum distillation. It separates paraffinic from asphaltic and aromatic compounds in vacuum-tower bottoms by using the unusual solvent properties of butane and propane in the region of their critical points, allowing the refiner to increase gasoline or furnace oil at the expense of fuel oil.

Originally considered a substitute for vacuum distillation, the process is now considered as a supplement to vacuum, recovering 40 to 75 per cent of profitable catalytic feed from residues which would otherwise go to fuel or thermal cracking.

Since catalytic gasoline is increased and thermal gasoline decreased, the octane potential of the refinery can be lifted by as much as two numbers. Distillate quality can alternately be raised by replacing light virgin stocks formerly charged to cracking with decarbonized oil. Olefins for alkylation, polymerization, or petrochemicals are increased even more than gasoline. Sulfur is retained in the asphalt.

Low temperatures . . . Solvent decarbonizing is a low-temperature process with extraction temperatures ranging from 100° to 250° F., at 400 to 600 psi. As a result, there is virtually no corrosion and fouling is slight. Substantiated maintenance records show annual costs under 2.5 per cent of the investment and on-stream times of 98 per cent or better.

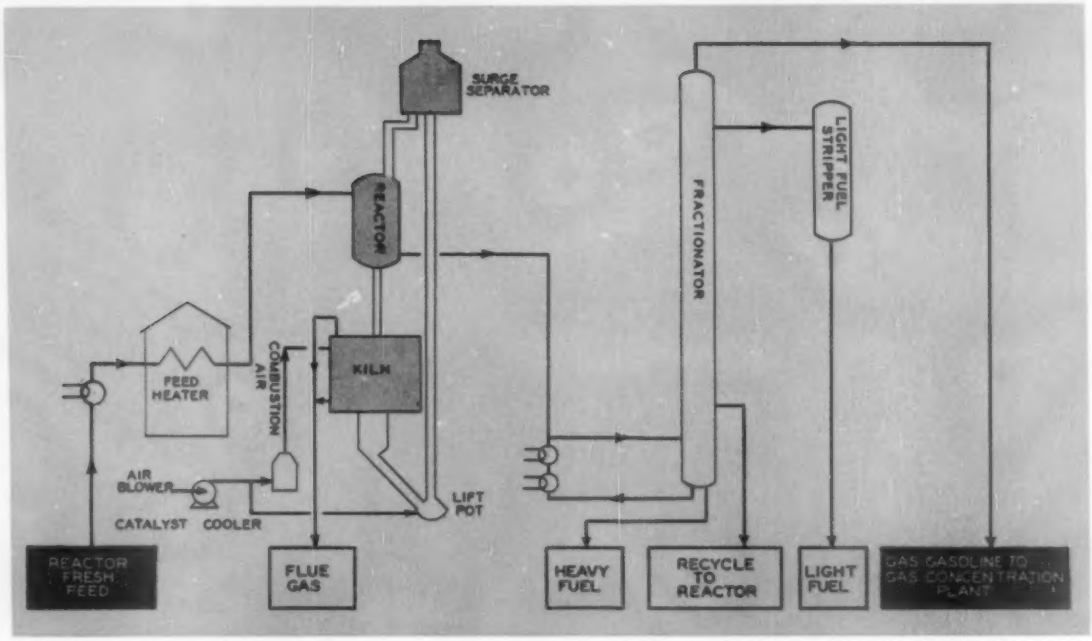
As shown in the process scheme, the residue feed is cooled prior to charging to the countercurrent towers. More viscous charge stocks are usually prediluted with a small amount of solvent to assist in optimum distribution. Decarbonized oil solution is heated under pressure to evaporate the solvent which is condensed for reuse. Final traces of solvent are removed by steam stripping at low pressure.

The rejected asphalt base, containing metals, salts, and other contaminants, is sufficiently fluid, in the presence of solvent, to handle easily. An asphalt furnace vaporizes contained solvent, which is separated and returned. Final stripping is accomplished similarly to the decarbonized oil. The asphalt may be cut back, hot, for bunker fuel, or blended for marketable asphalt.

Information on the process may be obtained from M. W. Kellogg Co., New York.

TYPICAL CRUDES, YIELDS, PRODUCT PROPERTIES

	Texas	Middle East	West Texas	Canadian
Reduced crude:				
Vol. per cent crude	11.1	22.2	29.2	16.0
Gravity, °A.P.I.	11.3	5.3	12.0	9.6
Conradson carbon, weight per cent	15.0	21.5	12.1	18.9
S.U.s. at 210° F.	2,193		526	
SiO_2-free ash, p.p.m.	489	350	936	265
Metals, p.p.m.:				
Vanadium	23.1	84.1	27.6	30.0
Nickel	14.2	27.6	16.0	46.6
Iron	18.2	13.2	13.2	39.3
Decarbonized oil:				
Vol. per cent charge	62.9	35.0	66.0	67.8
Gravity, °A.P.I.	19.0	19.3	19.6	17.8
Conradson carbon, weight per cent	4.2	4.3	2.2	5.4
S.U.s. at 210° F.	294	193	113	250
SiO_2-free ash, p.p.m.	9.2	8.8	6.2	10.7
Metals, p.p.m.:				
Vanadium	1.23	1.88	1.34	1.4
Nickel	1.10	0.92	0.99	3.9
Iron	0.49	0.96	0.66	Trace



Thermofor Catalytic Cracking

THE Thermofor catalytic cracking (T.C.C.) process is a modern, efficient method for converting a wide range of feed stocks to high-octane gasoline. Whole crude, kerosine, conventional virgin gas-oil fractions, residues of low asphaltene content, furfural extracts, visbreaker, and coker gas oils are presently being charged. At times, straightrun naphthas have also been concurrently processed with the realization of significant octane improvement and partial desulfurization.

The modern T.C.C. unit of today is the embodiment of engineering and operating experience dating back to the pioneer days of catalytic cracking. The result is a foolproof, low-cost unit permitting great flexibility in operating conditions. Standing in testimony are units on all continents of the world. They range in size from 1,600 to 33,000-bbl. per stream day and have been installed by all types of refiners from the smallest independent to the largest major. The total throughput capacity of the Socony Airlift T.C.C. units in operation, under construction and authorized, is well over 650,000 bbl. per day.

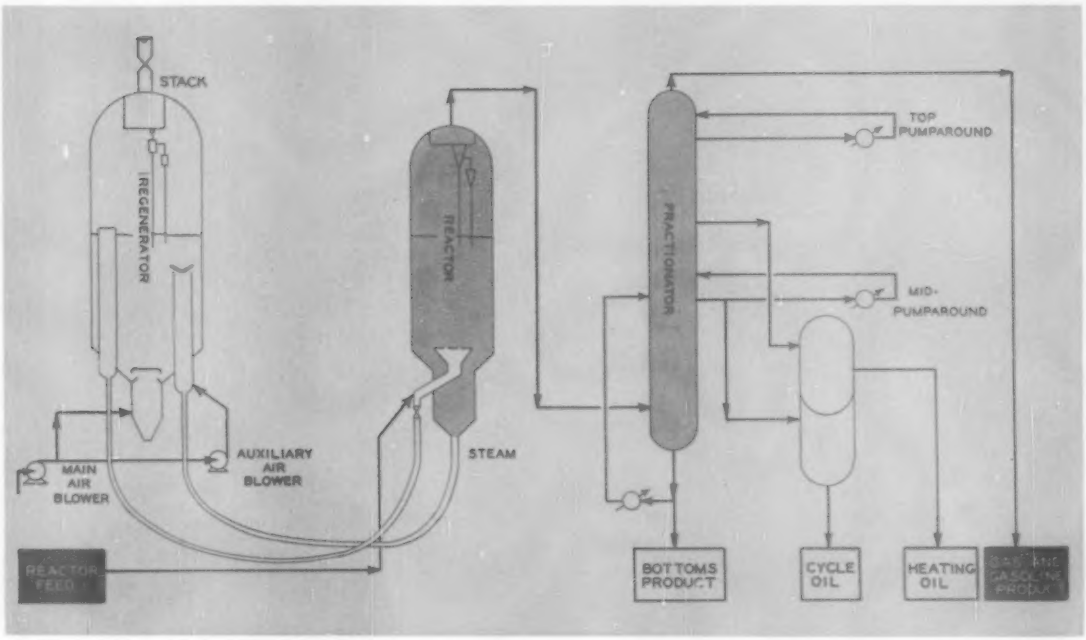
The moving solids-bed technique employed by the Socony Airlift T.C.C. process provides exceptionally uniform contact between the hydrocarbon charge and catalyst. Hence, over and undercracking are minimized—liquid recoveries are high—products are of uniform quality.

Cracking conditions . . . The high equilibrium catalyst activity inherent to the process makes possible the use of moderate cracking temperatures. Reaction products are rich in isomers and the formation of olefins is minimized. This, in part, is responsible for the high lead susceptibility and excellent road to research octane relationship characteristic of T.C.C. gasolines, and for the exceptional stability and good cetane numbers of the cycle stocks.

Generally speaking, isobutane production is sufficient not only to alkylate all the butylenes but also a portion of the propylenes. However, considerable flexibility exists to alter the ratio of iso to olefinic compounds, if desired. In spite of the high catalyst activity noted above, catalyst consumption is low and makeup to maintain activity very seldom required. T.C.C. units average 0.25 lb. total makeup of bead catalyst per barrel of feed.

FIELD DATA FROM COMMERCIAL UNITS

Crude type—	Mixed South America and Middle East	Kansas
Conversion, per cent volume	54.3	68.0
Yields:		
Gasoline, per cent volume	43.3	56.3
Light cycle, per cent volume	27.1	15.0
Heavy cycle, per cent volume	18.6	17.0
Butanes, per cent volume	7.5	10.8
Propanes, per cent volume	6.3	8.8
Ethane and lighter, per cent weight	3.5	2.3
Coke, per cent weight	5.8	5.2
Properties:		
Charge stock, gravity, °A.P.I.	27.3	26.5
10 per cent, °F.	670	657
50 per cent, °F.	872	835
90 per cent, °F.	995	1,021
Gasoline, R.v.p.	10.0	10.5
10 per cent, °F.	115	137
50 per cent, °F.	208	230
90 per cent, °F.	360	395
Road octane No., + 3 ml./TEL	96.6	97.2



Model IV Catalytic Cracking

FLUID catalytic cracking accounts for about three-quarters of the total installed catalytic cracking capacity in the world today.

A continuous process, fluid cat cracking produces excellent yields of high-octane gasoline. It also yields such important byproducts as isobutane and light olefins for alkylation and polymerization, as well as for use in making L.P.G. and synthetic rubber. Its inherent flexibility enables the refiner to meet shifting market demands.

Lower costs . . . The Model IV unit requires only a third of the steel used in original catalytic cracking designs. Absence of moving parts in locations of critical wear contributes to low maintenance costs and short turnaround time.

Side-by-side vessel elevation eliminates expansion joints and results in minimum over-all height. Substantially lower investment and operating costs in general result from the compactness of the Model IV and from improved mechanical and plant layout features.

Catalyst is transferred between vessels at moderate velocities by means of U-bends. In place of conventional slide-valve control, catalyst flow rate is varied by changing the amount of air injected into the spent catalyst U-bend.

Temperature is controlled by the regulation of catalyst rate. Feed is injected into the hot regenerated catalyst line just before it enters the reactor. Catalyst circulation rates as high as 70 tons per minute have been achieved in Model IV units.

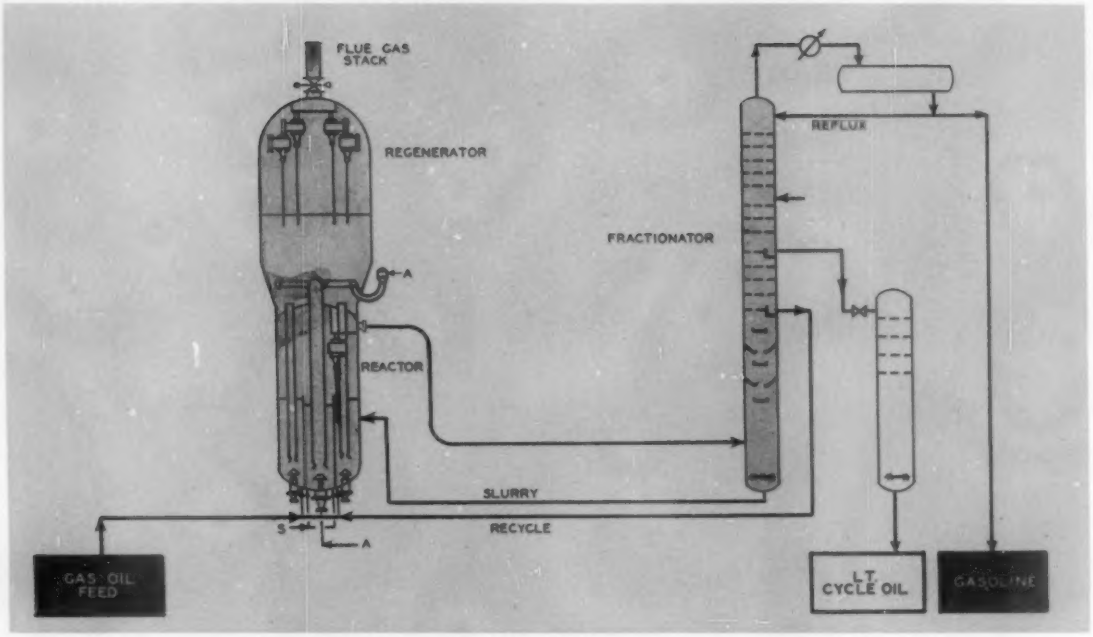
34 units . . . Thirty-four Model IV units with a total capacity of 630,000 bbl. a day have been built or ordered to date, and more are under consideration. Sixteen of these units have been licensed to refiners outside the Jersey Standard circuit. Installed Model IV units range in capacity from 4,880 to 55,000 bbl. a day total feed.

The Model IV cat cracking process is licensed by Esso Research & Engineering Co., New York.

Typical of the flexibility of the Model IV process are these examples of product distribution:

Model IV Product Distribution Is Flexible

Type operation—	Once-through	Recycle— Moderate	Recycle— High
Product distribution:			
Dry gas, wt. per cent	8.5	8.6	8.5
Total C_4, vol. per cent	17.1	16.5	15.6
C_5, 430° F., vol. per cent	43.8	51.8	57.0
Heating oil, vol. per cent	17.3	20.1	24.1
Heavy gas oil, vol. per cent	18.9	8.8	2.0
Carbon, wt. per cent	7.0	7.0	7.0



Orthoflow Fluid Catalytic Cracking

THE Orthoflow catalytic cracker, in which reactor and regenerator are combined in a single vertical structure, was developed for high-octane gasoline production at low investment cost. The Orthoflow design, developed and licensed by M. W. Kellogg Co., has proved to be remarkably free of erosion difficulties. The company is prepared to design and build side-by-side units of all types.

Two Orthoflow designs have been developed and proved commercially: Model A with the reactor above the regenerator, and Model B with the regenerator over the reactor.

In the improved Model B design, the pressure differential between reactor and regenerator is reversed, considerably reducing utilities requirements and operating costs. In effect, this design raises the suction pressure of the compressor handling reactor gas, and lowers the discharge pressure of the blower furnishing combustion air to the regenerator. The sizes of the reactor and fractionator are also reduced in this design.

17 units . . . At present 17 units of the Orthoflow design are operating or under construction—6 Model A units with a total throughput capacity of 46,500 bbl. per day, and 11 Model B units with a capacity of 310,000 bbl. a day.

The accompanying diagram illustrates the schematic flow of a typical Model B Orthoflow.

The Orthoflow, with in-line construction of the reactor and regenerator and the straight internal catalyst lines, represents the simplest design to date.

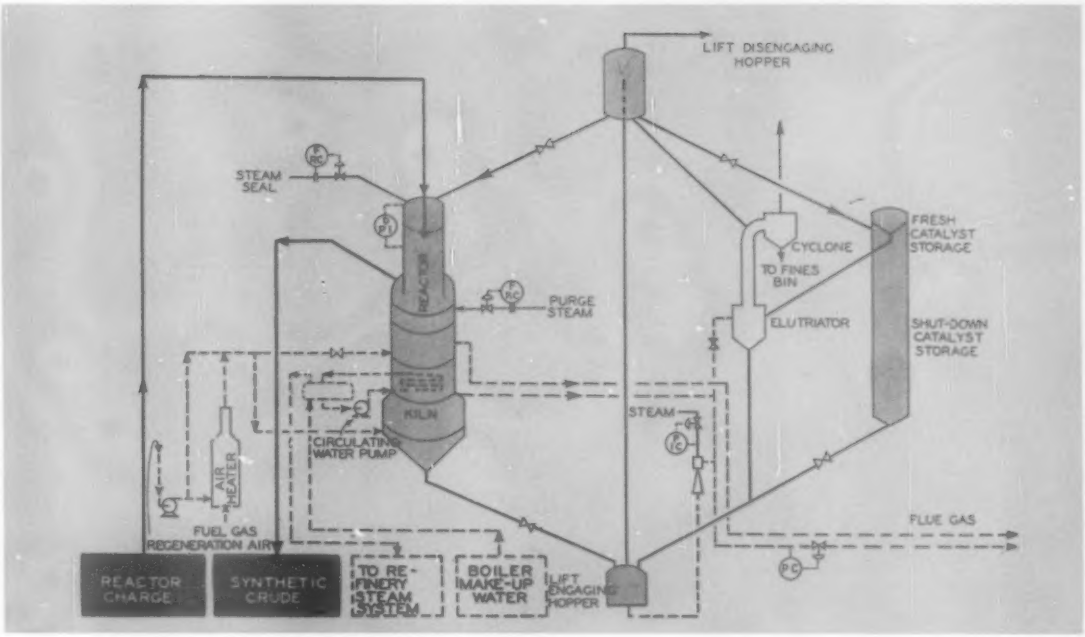
A major achievement in the Orthoflow design was the development of plug valves which regulate internal catalyst flow. Compared to the conventional slide valves, the Orthoflow valves eliminate expansion joints in many cases, and provide easier maintenance, less erosion, and no loss of control with wear.

Operating Conditions

Reactor temperature, °F.	885-950
Reactor pressure, psig.	14-16
Regenerator temperature, °F.	1,050-1,100
Regenerator pressure, psig.	8-10
Catalyst/oil ratio	8-12
Space velocity, w./hr./w.	1.0-3.0

Typical Yields from a Model B Orthoflow F.C.C.U.

Fresh feed, mixed gas oil, bbl. per day	17,600
Gravity, °A.P.I.	28.0
Throughput ratio	1.5
Conversion, vol. per cent	70.8
Tail gas, wt. per cent	7.8
C_3 to poly, wt. per cent	6.9
C_4+ gasoline, vol. per cent	58.0
Light cycle oil (No. 2 fuel), vol. per cent	23.5
Debutanized gasoline:	
Gasoline, °A.P.I.	58.0
R.v.p., psi.	7.0
50 per cent point, °F.	210
End point, °F.	420
C.R.R.-R. clear	92.0



Houdriflow

HOUDRIFLOW catalytic cracking is a continuous moving-bed process producing exceptional yields of motor gasolines with octane ratings in the 88-95 F-1 clear range (95-99 with 3 cc. TEL), depending on feed stock, temperature, and catalyst employed.

Conversion higher than 90 per cent is achieved with relatively low coke laydown when the recycle ratio is 1 to 1 or slightly higher. With once-through cracking, conversion of up to 60 per cent of charge is obtained.

Houdriflow units handle sweet and sour stocks equally well. Charge may be any fraction of the crude boiling between naphtha and penetration asphalt. Feed may be all liquid, all vapor, or a mixture of both. All but one of the Houdriflow units that have been placed on stream use charge stocks that are more than 50 per cent liquid. In some cases feed is completely liquid phase, and may consist entirely of accumulated cycle stock.

Catalyst . . . Either synthetic or natural catalyst may be used. Houdry mineral kaolin high-alumina pelleted cracking catalyst, first marketed in 1956, has demonstrated improved stability at extremely high temperatures, together with excellent activity and improved regeneration characteristics, with resulting increases in unit capacity.

The integrated catalytic reactor and regenerating kiln, and the hot catalyst storage vessel, are self-supporting, and are usually located on opposite sides of a steel structure housing a stairway and supporting the catalyst lift and elutriator. The regenerated catalyst is continuously recirculated by a pneumatic lift system.

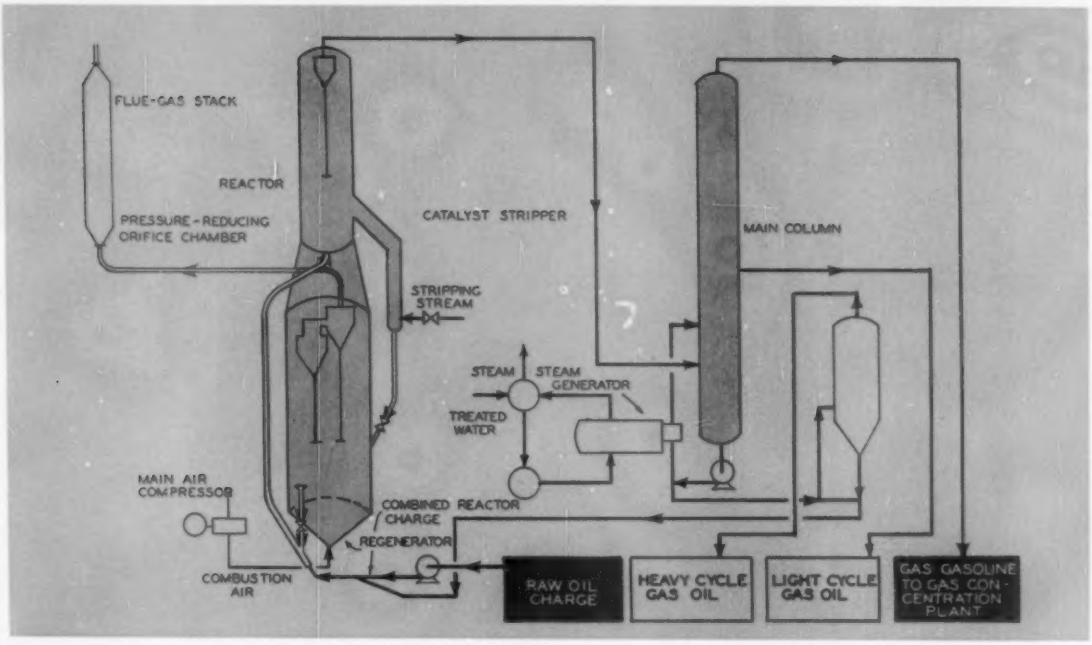
Typical operating conditions are: Temperature 850°-950° F.; pressure 9-10 psig.; space velocity 1.5-4 v./hr./v.; and catalyst-oil ratio 3-7.

Houdriflow catalytic cracking is noted for its ease of operation under normal or emergency conditions, low maintenance and operating cost, flexibility as to variety of charge stock, conversion levels attained, and high catalyst activity in conjunction with low catalyst makeup cost. A total of 21 units, with combined nominal design capacity of 278,430 bbl. per stream day, have been licensed.

TABLE 1—TYPICAL HOUDRIFLOW YIELDS WITH FEEDS OF VARIOUS COMPOSITION

Charge:*	A	B	C
Virgin gas oil	5,810	4,460	4,750
First pass cat. gas oil	1,430		
Recycle		2,200	5,700
Total charge, bbl. per day	7,240	6,660	10,450
Products:			
Gasoline, 10 lb., 380/90, volume per cent	40.8	53.7	67.8
Total gas oil, volume per cent	50.3	31.1	9.2
C_3-C_4 recovered, volume per cent	16.1	18.6	25.0
Liquid recovery, volume per cent	107.2	103.4	102.0
Fuel gas, weight per cent	3.8	5.8	7.3
Catalyst deposit, weight per cent	5.2	5.4	9.0
Gasoline octanes:			
F-1 clear	91.5	90.6	89.3
F-1 + 3 cc. TEL			96.7
F-2 clear	81.7		

*Charge stocks are atmospheric plus vacuum gas oils from: (A) Texas pipeline crude, (B) Scurry crude, and (C) Hutchinson-Moore County, West Texas, crude.



Fluid Catalytic Cracking (U.O.P.)

THE U.O.P. fluid catalytic cracking process is a modern, highly developed method of producing high-octane gasolines from a large variety of gas oils. The fluid principle gives intimate contact between charge and catalyst in the reactor, and optimum regeneration conditions in the regenerator. The energy required for catalyst circulation is furnished by vaporizing the charge by direct contact with the hot, regenerated catalyst and maintaining a reactor pressure lower than in the regenerator.

A large variety of charge stocks from all types of crude oils may be cracked by the process. Typical charge stocks include naphtha, kerosine, light gas oil, distillate, heavy atmospheric and vacuum gas oils, distillates from viscosity breaking or coking, and certain desalted crude oils.

High-sulfur feeds containing large amounts of nitrogen may be successfully processed without operating penalties. Because the charge is heated by direct contact with regenerated catalyst, a heavy charge which would rapidly coke up a feed preheater may be handled without difficulty.

Heat-balance unit . . . The accompanying flow diagram is typical for a 5,000-bbl. per stream day unit of the heat-balance type, which eliminates feed preheaters and catalyst coolers and permits generating of much of the steam required in process and as power for prime movers.

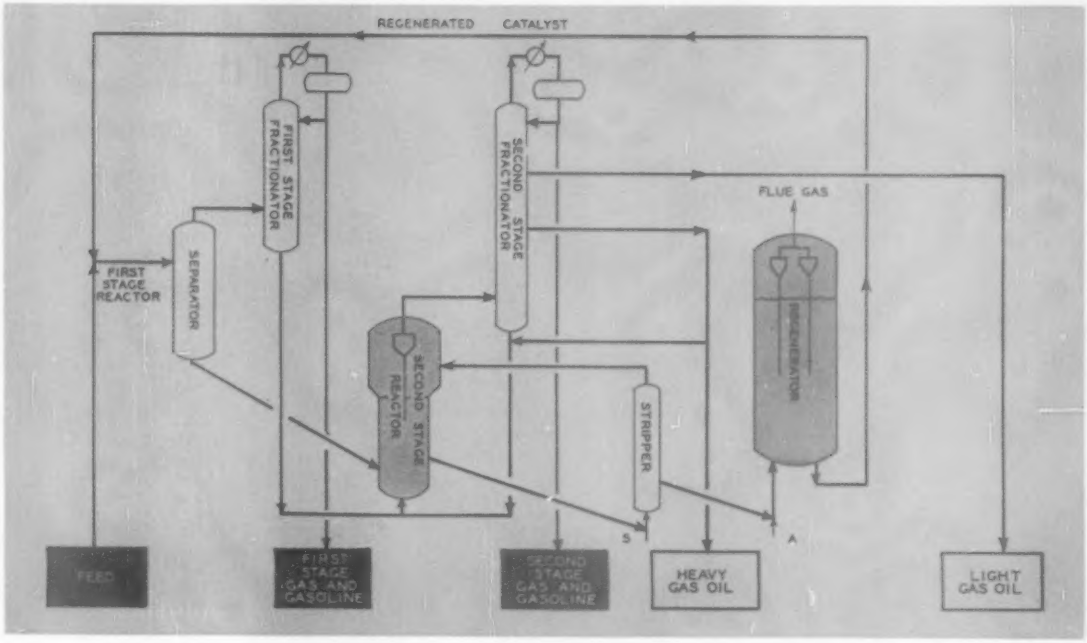
Typical yields from a U.O.P. fluid catalytic cracking unit, charging a 31° A.P.I. Mid-Continent gas oil over a silica-alumina catalyst, are shown in Table 1 for once-through and recycle operation. Yields when charging a 27° A.P.I. Oklahoma gas oil are shown in Table 2. At the present time there are over 70 catalytic cracking units designed by U.O.P. in operation or under construction. They represent a total design feed capacity of over 620,000 bbl. per day.

TABLE 1—TYPICAL YIELDS

Operation—	Once-through	Recycle
Conversion, vol. per cent gas oil disappearance	60	75
Yields (vol. per cent):		
Debutanized gasoline	45.0	53.0
Cycle stocks	40.0	25.0
Butylenes	5.8	7.1
Butanes	8.7	9.4
Propylene	5.2	6.4
Propane	2.4	3.3
C_2 and lighter, wt. per cent	2.5	3.1
Octanes, 10-lb. R.v.p. gasoline:		
Motor method, clear	81.8	81.8
With 3 ml. TEL	86.8	87.4
Research method, clear	93.7	94.2
With 3 ml. TEL	98.7	99.1
Yields with polymerization, vol. per cent:		
10-lb. R.v.p. polymer gasoline	8.0	9.9
10-lb. R.v.p. catalytic gasoline	47.7	55.8
Total 10-lb. R.v.p. gasoline	55.4	65.7

TABLE 2—YIELDS, OKLAHOMA GAS-OIL CHARGE

Conversion, vol. per cent gas-oil disappearance	70
Yields, vol. per cent:	
Debutanized gasoline	50.5
Light cycle oil	25.0
Heavy cycle oil	5.0
Butylenes	6.0
Isobutane	5.2
n-Butane	1.7
Propane, propylene, ethane, ethylene, total wt. per cent	7.8
Combined feed ratio, by volume	1.66
Catalyst-to-oil ratio:	
On raw oil	19.1
On combined feed	11.3
Weight hourly space velocity:	
On raw oil	6.2
On combined feed	9.5



Two-Stage Fluid Catalytic Cracking

IN the Shell two-stage fluid catalytic cracking process the charge is cracked in two stages. The first stage is operated at high temperatures and short residence time. The effluent from the first stage, after catalyst separation, is fractionated to remove lighter, less-refractory product hydrocarbons, and the bottoms are sent to the second stage for a longer, more thorough cracking. By this technique, higher gasoline yield and lower coke make are realized, and the cracking process is given greater flexibility for shifting production between maximum gasoline and maximum intermediates.

The process flow scheme is shown in the accompanying diagram. Feed and hot regenerated catalyst flow concurrently up through the first-stage riser reactor in which the retention time is very short. The effluent mixture passes to a high-load separator where the partially spent catalyst is removed from the hydrocarbon products of the first-stage cracking.

The heavier unconverted or insufficiently converted material is removed from the fractionator as bottoms and sent to the second-stage reactor where the partially spent catalyst again contacts the hydrocarbons, and additional cracking is effected.

Advantages . . . When cracking is carried out in a single stage, the less-refractory components are generally cracked too severely to gas and coke, whereas the more refractory components are cracked too lightly to desirable products. This overcracking and undercracking lowers the yields of desirable products that may otherwise be obtained. Two-stage cracking improves this condition by effecting a relatively light cracking in a first stage, removing the resulting cracked products, and then effecting a more severe cracking on the remaining, more refractory components.

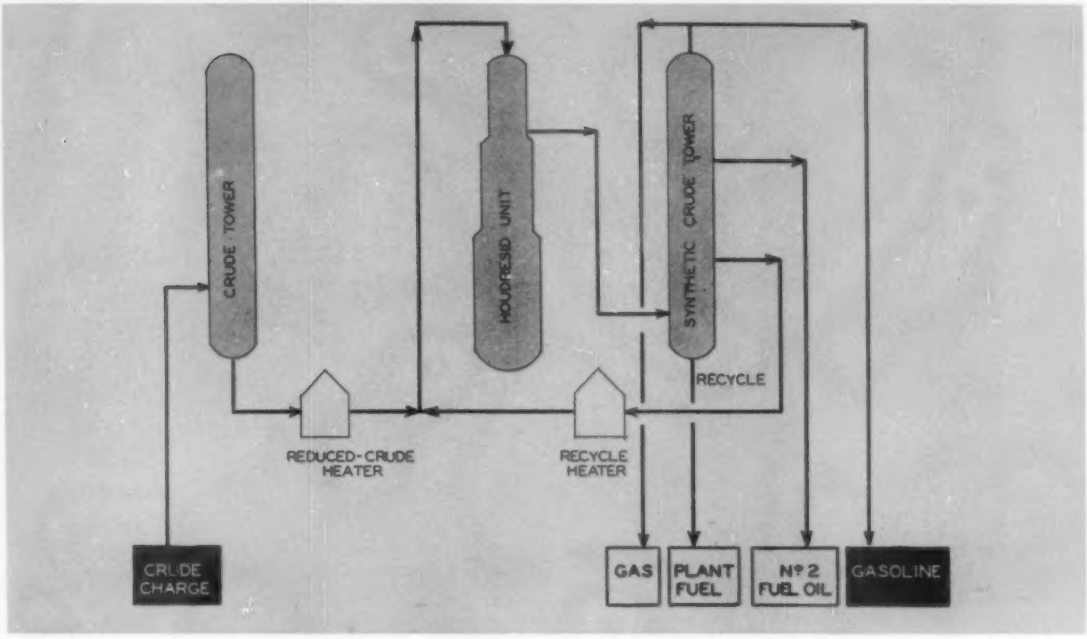
The two-stage technique also improves the operating flexibility of the cracking process for changing the yield structure from a given feed stock.

The principles of this process can, in some instances, be applied to existing fluid cat cracking units by addition of a riser reactor and accompanying facilities.

Results . . . Two-stage catalytic cracking has been operating commercially with a mixture of Alberta feeds. The following table gives the properties of the feed and the distribution of the resulting products:

Alberta feed stock:	
°A.P.I. gravity	23.7
A.S.T.M. distillation, °F.:	
I.b.p.	508
10 per cent by volume	620
Pour point, °F.	+85
Ramsbottom carbon residue, wt. per cent	0.83
Sulfur, wt. per cent	1.26
Viscosity at 210° F., S.s.U., vol. per cent	51
Product distribution, unless shown:	
Ethane and lighter (s.c.f.b.)	(340)
Propylene	8.0
Propane	4.5
Butylenes	12.7
Butanes	5.1
Debutanized gasoline	53.3
Light gas oil	12.2
Heavy gas oil	12.4
Coke, per cent by weight	(6.5)
Conversion	75.4

The first commercial unit using this new technique was built in Shell Oil's refinery at Anacortes, Wash. The process is licensed by Shell Development Co. through M. W. Kellogg Co. and Universal Oil Products Co.



Houdresid

HOUDRESID catalytic cracking is a refinery-proved continuous moving-bed process charging reduced crude to produce noteworthy yields of high-octane gasoline and light distillate fuels. Heavy residual fuel is eliminated, and the gasoline product is in the range of 90-95 F-1 clear.

Residuum cuts ranging from atmospheric tower bottoms to vacuum bottoms may be charged to the Houdresid unit, thereby permitting great flexibility in the kind of crude that may be run. If desired, the entire crude may be charged.

Novel process features prevent the adverse effects on product selectivity and catalyst life heretofore resulting when heavy metals are present in the feed. In addition, residua high in sulfur and nitrogen may be charged to Houdresid units.

Catalysts . . . Both natural and synthetic catalysts may be used. Houdry mineral kaolin high-alumina pelleted catalyst, distinguished for activity, stability at extremely high operating temperatures, and speed in regeneration, is particularly well suited to Houdresid processing.

In commercial operation, it has been demonstrated that catalyst attrition averages 0.4 to 0.5 lb. of catalyst per barrel of reactor charge, without necessity for withdrawal of catalyst, over requirements from normal mechanical loss, in order to maintain selectivity and activity.

Results . . . In Houdresid refinery operations charging reduced crude from mixed Mid-Continent, Texas, and Louisiana crudes, conversion ranged from 65 to 70 volume per cent, depending on changes in throughput, recycle ratio, space rate, catalyst-oil ratio, and temperature. C_5 gasoline yields varied from 48 to 53 volume per cent and coke laydown on catalyst between 5.9 and 8.2 weight per cent.

Houdresid process also provides a greater potential polymer gasoline yield from polymerization of C_3 and C_4 cuts for blending into final high-octane product, as well as favorable proportions of No. 2 domestic fuel oil.

Three commercial units, with a total combined capacity of 62,500 bbl. per stream day, have been designed and built to accommodate Houdresid processing.

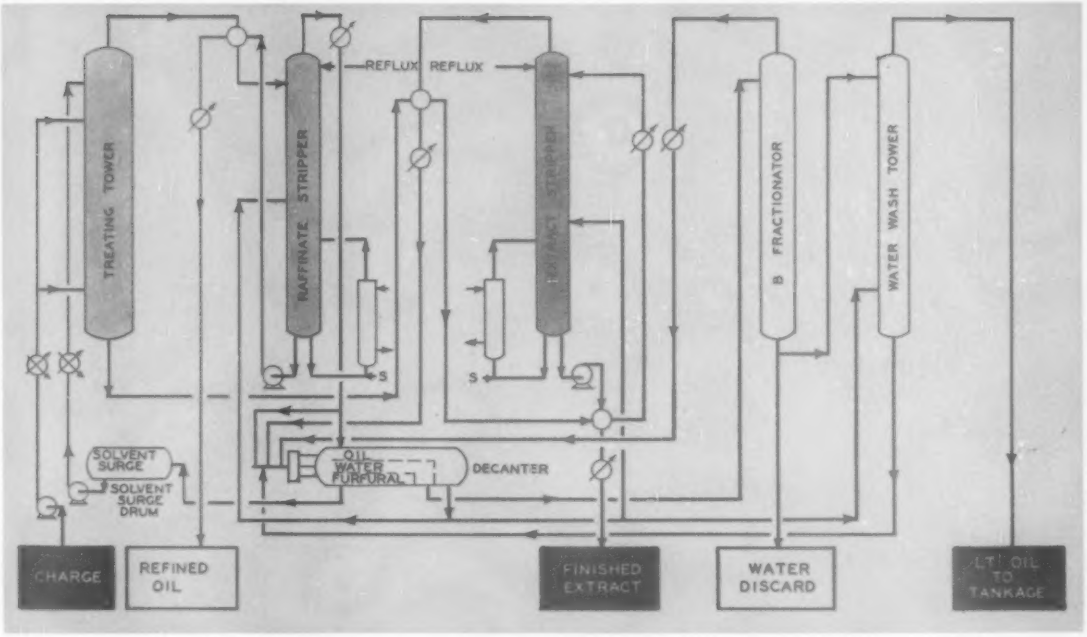
HOUDRESID PROCESSING OF MIXED MID-CONTINENT, TEXAS AND LOUISIANA CRUDES

Charge to Houdresid unit (b.p.s.d.)	7,364	10,009
Reduced crude	(5,020)	(6,410)
Recycle	(2,344)	(3,599)
Inspection of charge:		
Gravity, °A.P.I.	26.9	
Sulfur, weight per cent	0.47	
Yields (based on fresh feed):		
Conversion, volume per cent	67.6	67.6
Debutanized gasoline, volume per cent	48.5	51.6
C_4 cut, volume per cent	14.8	13.1
Dry gas, weight per cent	10.3	7.9
Coke, weight per cent	7.1	5.9
Hydrogen, s.c.f./bbl. residuum converted	129	138
Inspection of C_5+ gasoline:		
Octane, F-1 clear	93.0	91.6
Sulfur, weight per cent	0.08	0.08

HOUDRESID PROCESSING OF HEAVY RESIDUA

Charge stock—	10%†	10.6%*	4.1%*
Gravity, °A.P.I.	12.6	17.7	12.7
Sulfur, weight per cent	0.91	0.72	1.02
Yields, per cent of fresh feed	Once-through	Once-through	Once-through
Debut. gaso., vol. per cent	40.1	42.6	40.4
Cat. gas oil, vol. per cent	40.2	37.0	27.1
C_4's, vol. per cent	10.4	13.1	15.6
Dry gas, wt. per cent	7.3	11.6	13.5
Coke, wt. per cent	16.3	8.5	17.6
Inspections of C_5+ gasoline:			
F-1 clear octane	89.3	93.4	90.7

*South Central Texas mixed reduced crude. †Mixed Mid-Continent, Texas, and Louisiana reduced crude.



Furfural Refining

THE application of furfural refining to the cycle gas oils produced from catalytic cracking units, as well as to virgin gas-oil cracking stocks, is a successful and versatile process. This is borne out by more than 7 years of plant experience.

Extraction of light cycle gas oil in variable combination with heavy cycle gas oil results in a high yield of refined oil having a low sulfur content. A.P.I. gravity is several degrees higher than that of the feed stock. By extraction metal contaminants and nitrogen as well as sulfur compounds are removed from virgin cracking stocks and aromatics from heavy cycle gas oil, thus improving cracking operations, when either or both are charged to catalytic cracking.

Cat cracking of furfural-refined cycle stocks results in a product distribution comparable to that obtained in cracking the virgin gas oil of similar boiling range, from which the cycle stock was derived. Refined oil produces an equal total-butane-retention gasoline yield and more butane and less dry gas.

Product gasoline from cracking refined oil has lower sulfur content, higher octane rating, and lower average boiling point. Light cycle gas oil produced from refined oil has lower sulfur content and appreciably higher aniline point than that obtained cracking unrefined virgin gas oil.

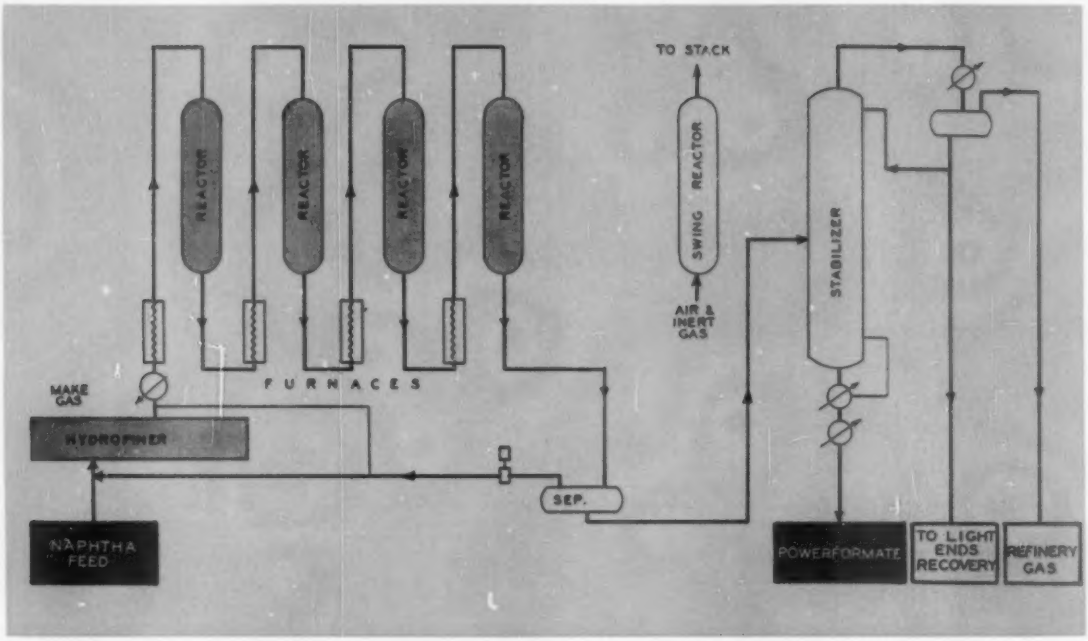
Some representative data showing result of refining cycle gas oils are presented in Table 1. Refining also has been applied to heavy cycle stocks with aromatic contents of 40 to 45 per cent yielding about 65 per cent raffinate containing 10 to 13 per cent aromatics, while the aromatic content of the extract ranged from 92 to 94 per cent.

The furfural-refining process was developed by The Texas Co. and is licensed by Texaco Development Corp. Three units, with a capacity of 18,760 bbl. per day, are now being used for extraction of cat cycle stocks.

TABLE 1—FURFURAL REFINING OF CYCLE GAS OILS

	Light cycle oils							Mixed cycle oils				
Refined oil yield, vol. per cent charge from unit weight balance		71.1		75.8		79.3			67.9		65.3	
Steam quality—	Charge	Refined oil	Extract	Refined oil	Extract	Refined oil	Extract	Charge	Refined oil	Extract	Refined oil	Extract
Gravity, °A.P.I.	31.4	41.6	10.5	39.8	10.0	38.2	10.1	24.5	36.3	4.5	38.1	3.7
Distillation, °F.:												
I.b.p.	484	485	500	478	502	483	500	480	484	494	481	495
10 per cent	505	504	510	500	517	503	512	506	505	517	503	519
50 per cent	528	528	534	525	538	527	534	557	546	606	544	608
90 per cent	567	570	582	565	589	567	590	749	724	*710	724	*708
End point	595	596	628	592	630	596	632	....	....	....	....	....
Viscosity-S.s.U. at 100° F.	36.1	36.5	37.5	36.4	37.6	36.3	37.6	42.9	40.1	61.9	40.3	62.4
Pour point, °F.	+5	+15	....	+10	....	+10	....	+10	+55	....	....	....
Aniline point, °C.	59.1	80.7	....	75.6	....	73.4	....	60.7	79.8	....	83.0	....
Sulfur, wt. per cent	1.10	0.19	2.96	0.35	3.10	0.44	3.15	1.70	0.61	3.59	0.44	3.63
Cetane number	42.5	64.2	....	60.0	....	57.0	....	....	....	....	....	....

*A.S.T.M. distillation 70 per cent point.



Powerforming

POWERFORMING is a fixed-bed catalytic reforming process using a platinum catalyst developed by Esso Research & Engineering Co.

The process upgrades low-octane naphthas to high-octane motor-gasoline components. It also can be operated to produce aviation blending stocks, or to give high yields of aromatics.

Powerforming typically uses five reactors with four on stream while the catalyst in the idle one is being regenerated by a newly perfected technique. This periodic regeneration maintains high catalyst activity over long periods of operation.

Feed stocks . . . Typical feed stocks consist of low-octane naphthas in the boiling range from 160° to 400° F.

Where more favorable feed stocks are used, or where only moderate octane improvement is required, the swing reactor can be deleted and an intermittent regeneration system employed.

With poorer feed stocks, or for the production of very high octane products, the swing reactor permits continuous operation at minimum catalyst cost. A Powerformer can be designed to produce naphtha with a research clear octane number up to 100 even from highly paraffinic virgin naphtha.

Other equipment . . . In addition to the reactor system, Powerformers include a feed Hydrofiner, a recycle gas system, and a stabilizer.

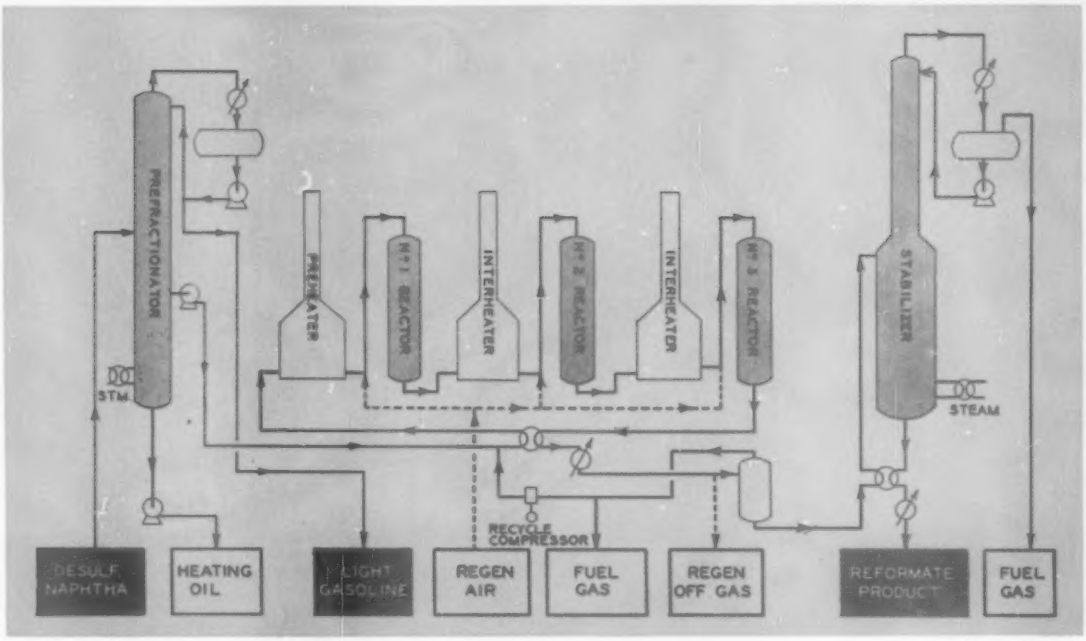
Blocked operations can be employed to provide reformate specifically tailored for a refiner's regular and premium grade, and a special arrangement of light-ends facilities can be incorporated to obtain C_3 recoveries of greater than 90 per cent and C_4 recoveries of 99-plus per cent.

Twenty-seven Powerforming units are now in operation, under construction, or in various stages of design. They represent a combined capacity of nearly a quarter of a million barrels a stream day.

POWERFORMING OPERATING RESULTS

	Case 1*	Case 2*	Case 3	Case 4
Feed source	Arabian	Arabian	Mixed La. W. Tex.	
Nominal cut range, °F.	160/300	300/385	200/330	200/300
Feed properties:				
Gravity, °A.P.I.	61.6	49.6	55.0	53.0
Research O.N. clear	42	26	58	56
A.S.T.M. 5% point, °F.	190	310	223	235
A.S.T.M. 50% point, °F.	236	342	253	260
A.S.T.M. 95% point, °F.	294	380	304	291
Watson K factor	12.1	11.9	11.8	11.7
Yields, per cent on feed:				
C_5+, vol. per cent	64.3	78.3	77.5	81.0
H_2, wt. per cent	1.3	1.3	2.1	2.0
C_1, wt. per cent	2.3	1.3	1.7	1.5
C_2, wt. per cent	5.9	2.8	2.9	2.5
C_3, wt. per cent	10.0	5.7	5.1	4.4
C_4, vol. per cent	15.0	8.4	8.8	7.8
C_5+ reformate properties:				
Volatility, per cent D plus L at:				
158° F.	22	2	4	5
212° F.	50	16	29	21
257° F.	73	29	60	59
302° F.	90	45	84	85
356° F.	97	74	96	98
A.S.T.M. final b. pt., °F.	392	†444	402	385
Gravity, °A.P.I.	49.0	40.0	45.9	44.3
R.v.p., psi.	7.5	2.7	4.0	3.5
Octane numbers:				
Research clear	100	100	100	100
Research + 3 cc. TEL	105.6	105.6	105.6	105.6
Motor clear	88.6	88.6	88.6	88.6
Motor + 3 cc. TEL	94.6	93.2	93.1	93.1

*An Arabian 160/385 has been split into two fractions for running in blocked operations in Cases 1 and 2. †Before rerunning.



Catalytic Reforming (Sinclair)

SINCLAIR RESEARCH LABORATORIES, INC., and Baker & Co. announced in May 1953 the development of a new platinum catalyst as the basis for an improved reforming process. This RD-150 catalyst and associated process has been designed for flexible and efficient processing of any quality naphtha to meet varying product requirements. Current installed operating capacity is in excess of 200,000 bbl. per day with an additional capacity of 135,000 bbl. per day under design or construction, for a total of 37 units.

The RD-150 catalyst is characterized by high naphthene dehydrogenation and paraffin cyclization activities, selective isomerization activity, low hydrocracking activity, and resistance to permanent poisoning effects of normal concentrations of nitrogen, sulfur, and water in the naphtha feed. This catalyst offers the additional feature of maintenance of virgin yield structure throughout the normal operating cycle. The design of a typical processing system is shown on the flow sheet.

Regeneration . . . Catalyst regeneration is required when the accumulation of carbonaceous materials has reduced the activity and selectivity below acceptable economic limits. The regeneration is accomplished by stopping the naphtha flow, purging and pressuring of the system with inert gas, and then admitting air while maintaining inert-gas circulation until the burning is completed. Naphtha processing is then resumed after the inert gas is purged from the system.

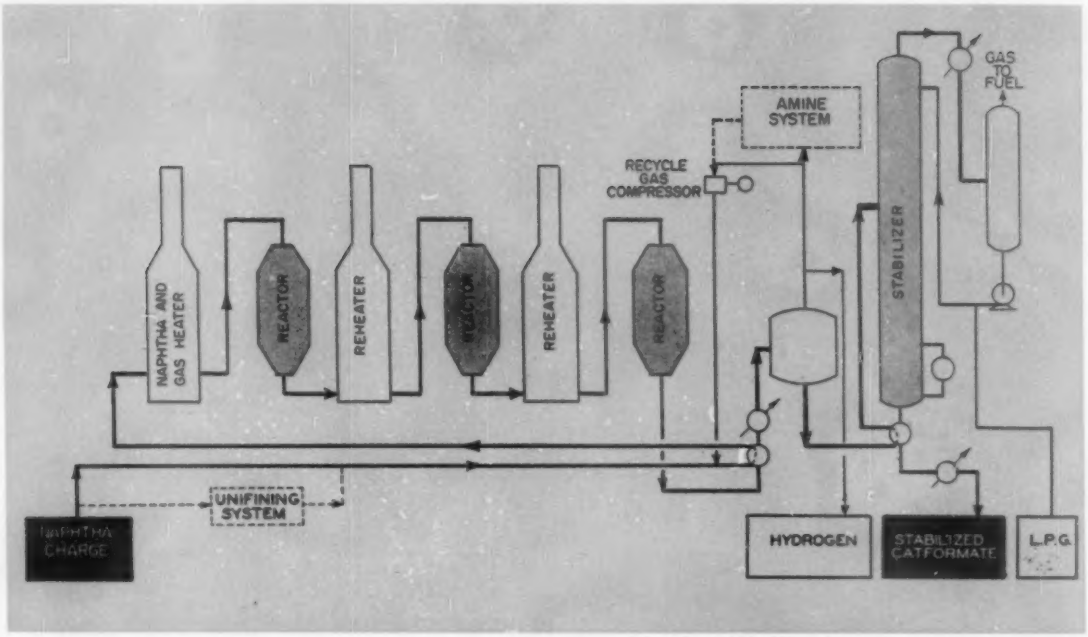
The regenerative nature of the RD-150 catalyst permits wide variation in operating conditions, and thus the unit can be "tailor made" for the processing of any naphtha charge stock. The operating conditions can be varied over the following ranges: 200-750 psig., 850°-975° F. reactor inlet temperature, 1-5 weight hourly space velocity based upon fresh feed, and 3 to 10 molal gas recycle ratio.

Typical yield data are shown for a light Mid-Continent naphtha over a range in unit operating pressure and processing severity to illustrate the flexibility of the catalyst.

The RD-150 catalyst is supplied by Baker & Co., who will also process the used catalyst for platinum recovery. M. W. Kellogg is also offering the RD-150 catalyst and associated process for fixed-bed units.

TABLE 1—CATALYTIC REFORMING WITH RD-150 CATALYST—YIELD SUMMARY

Feed-stock inspection:						
Gravity	60.1					
I.b.p., °F.	183					
10 per cent	204					
50 per cent	226					
90 per cent	270					
End point, °F.	299					
Chemical composition:						
Paraffins, vol. per cent	51.0					
Naphthenes, vol. per cent	45.0					
Aromatics, vol. per cent	4.0					
Octanes:						
Research, clear	55.8					
Research, +3 cc. TEL	77.5					
Yields:						
Operating pressure	Low		Intermediate		High	
Research octane level	85.0	95.0	85.0	95.0	85.0	95.0
Dry gas, wt. per cent	4.7	7.9	6.5	10.8	8.0	14.3
Butanes, vol. per cent	2.8	4.9	4.2	7.2	5.9	10.0
C_4-e.p., vol. per cent	91.4	87.4	90.8	85.8	90.4	83.8
C_5-e.p., vol. per cent	88.6	82.5	86.6	78.6	84.5	73.8
C_5-e.p. reformate inspections:						
Gravity	50.8	47.4	52.4	48.8	53.8	49.8
R.v.p.	2.7	3.6	3.2	3.9	3.6	4.3
Research method, clear	85.0	95.0	85.0	95.0	85.0	95.0
Research method, +3 cc. EL	96.5	101.7	96.5	101.7	96.5	101.7



Catforming

CATFORMING, a process for producing high-octane gasoline from low-quality naphthas with minimum operating and investment costs, was first announced to the petroleum industry in February 1951. Continued development of the Catforming catalyst has made it possible to meet the increasing demands for super octanes with maximum economy. The catalyst differs from other platinum reforming catalysts in that it is built on a silica-alumina carrier and, therefore, it has many distinctive properties.

1. The catalyst has a complete tolerance for water which permits charging saturated streams without drying or prefractionation.

2. A high yield of gasoline is achieved during the entire period of operation. The yield-octane relationship does not depreciate significantly as the catalyst ages, nor does it change after regeneration.

3. Because of complete tolerance for nitrogen, naphtha feed stock containing nitrogen does not have to be rejected or pretreated to reduce nitrogen.

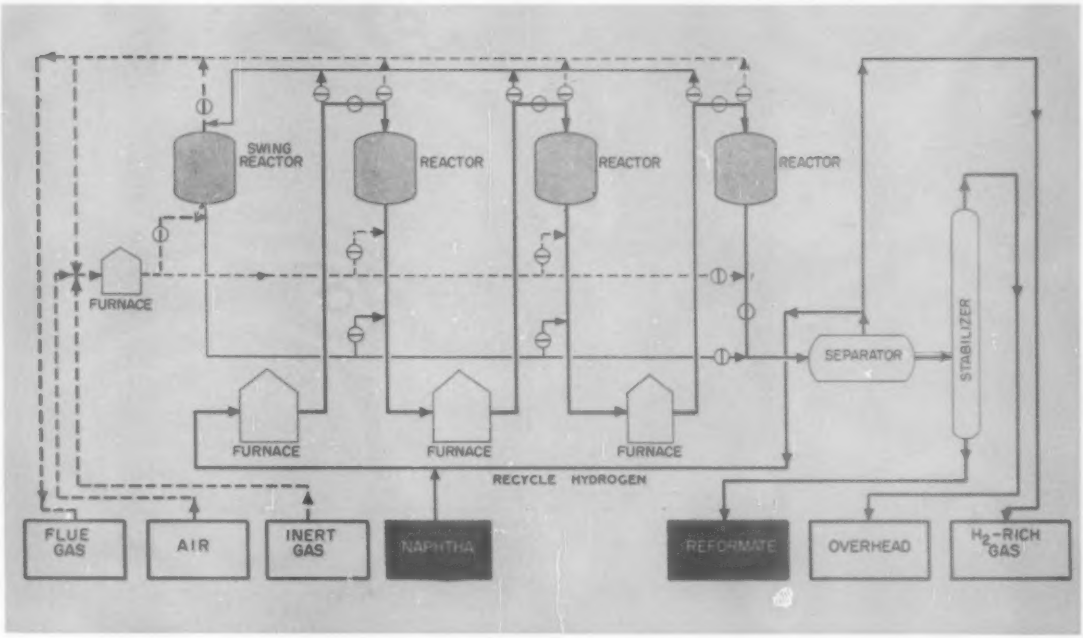
4. The process is designed for long on-stream time before regeneration is required. Carbon may be removed from the catalyst after an extended period of operation or after an operating upset by passing air and steam over the catalyst on a once-through basis. No expensive regeneration equipment is required.

Process results . . . Premium product requirements at octane levels of 100 and above can be produced by Catforming low-quality feed stocks. Table 1 shows typical charge and product yields and quality from a variety of crude sources. Process designs and processing procedures are provided to meet individual refiners' specific needs and assure the minimum investment in equipment.

There are 25 Catformers operating or under construction with capacities ranging from 600 to 15,000 bbl. per day. The average unit daily capacity is 5,000 bbl. Of these installations, five are combination Unifiner-Catformer units. Combined Unifining-Catforming is available under the normal Catforming license agreement with Atlantic Refining Co.

TABLE 1—TYPICAL GUARANTEED PERFORMANCE OF CATFORMING UNITS

Charge stock:	Kuwait (Burgan)		Iraq (Kirkuk)		Arabian (Export)		West Texas	Calif.
Gravity, °A.P.I.	55.4		55.4		54.7		54.0	46.9
Per cent sulfur	0.041		0.087		0.06		0.140	0.14
F-1 clear octane	30.8		39.6		31.8		53	60.2
A.S.T.M. distillation, °F.:								
I.b.p.	205		210		210		216	284
50 per cent	275		275		280		273	309
E.p.	350		350		350		348	360
Products:	Mild reforming	Severe reforming	Mild reforming	Severe reforming	Mild reforming	Severe reforming	Mild reforming	Mild reforming
C_4+ yield	93.5	90.9	93.2	90.4	93.7	91.2	95.3	94.1
10-lb. R.v.p. yield	94.2	80.5	94.4	79.8	94.2	80.2	102.3	101.5
F-1 clear octane	80.8	90.7	85.1	94.3	82.5	92.6	84.4	92.0
F-1 + 3 cc. TEL	94.5	99.8	96.7	101.5	95.4	100.7	95.4	99.9
Per cent sulfur	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001



Ultraforming

ULTRAFORMING is a regenerative, fixed-bed catalytic reforming process used to convert low-octane naphthas to high-octane blending stocks. Ultraforming differs from other processes employing platinum catalysts by using lower reaction pressures and a unique catalyst regeneration technique.

Low-pressure reforming produces higher gasoline, aromatic, and byproduct hydrogen yields. Ultraforming's catalyst-regeneration technique can continuously maintain catalytic activity even when naphthas having poor reforming characteristics are reformed to high octane levels. The octane ceiling with Ultraforming is determined only by economics associated with decreased gasoline yields at increased reforming severities.

Because Ultraforming's low operating pressure produces maximum gasoline yields, the process offers maximum flexibility in reforming to very high-octane levels. Still an additional advantage for Ultraforming is easy recovery from operating upsets which may deactivate the catalyst. In such cases Ultraforming's regeneration technique fully restores catalyst activity.

Ultraforming is usually carried out at a reactor pressure of 200-300 psi. and a reactor-inlet temperature of 900°-950° F. Hydrogen recycle rate and space velocity are adjusted to the particular characteristics of the charge and to the product desired.

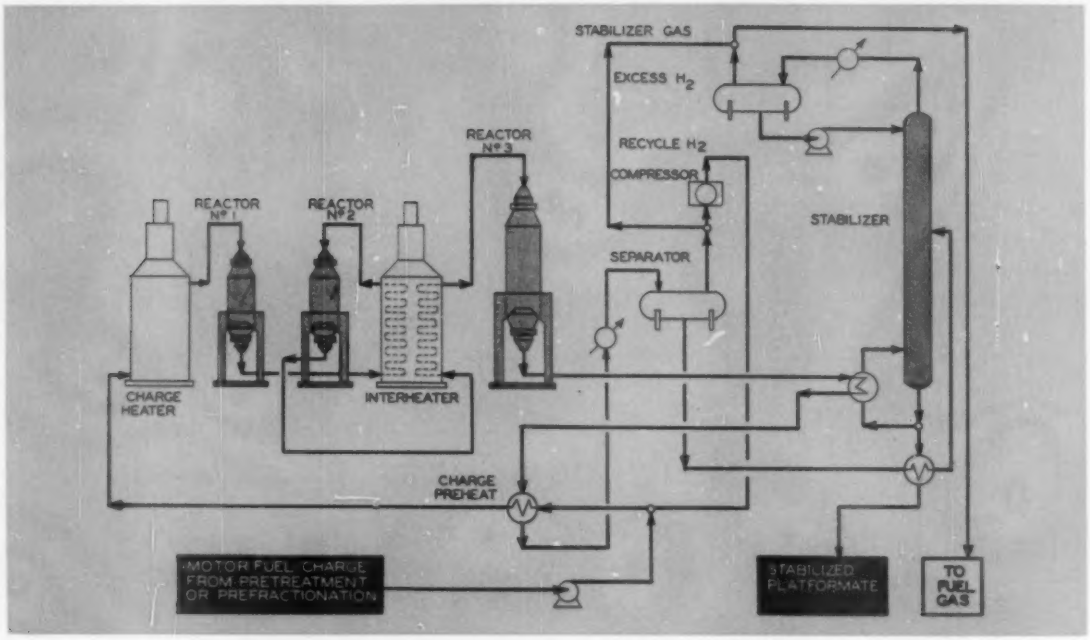
In the flow diagram, catalyst in the swing reactor is being regenerated while naphtha is being processed in the other three reactors. The predominant reactions are endothermic and cause a temperature drop across each reactor.

In commercial units which have operated over several years, fresh catalyst activity is being maintained even after reforming well over 100 bbl. of charge per pound of catalyst and regenerating catalyst in excess of 125 times. The combined capacity of Ultraforming units, in operation and under construction, is about 250,000 bbl. per day. Units range in size from 2,500 to about 21,000 bbl. per day.

Ultraforming process licenses are available from Standard Oil Co. (Ind.). They give operating rights under patents of Standard (Indiana) and Esso Research & Engineering Co., including future improvements.

TABLE 1—ULTRAFORMING YIELDS

Charge naphtha—	Gulf Coast		Mid-Continent		Kuwait	
A.S.T.M. dist., °F.:						
Initial	189		193		193	
10 per cent	212		239		220	
50 per cent	254		280		266	
90 per cent	324		328		330	
End point	360		360		366	
Composition, vol. per cent:						
Paraffins	28		48		70	
Naphthenes	63		44		19	
Aromatics	9		8		11	
Oct. No., research:						
Clear	66		45		35	
Products—C_5+ reformate:						
Oct. No., research, clear	90	100	90	100	90	95
Yield, vol. per cent	90.5	80.7	85.6	76.4	79.5	74.6
R.v.p.	2.4	3.2	3.2	4.7	4.6	5.0
Butanes, vol. per cent	1.7	5.8	4.3	8.4	8.7	11.3
Dry gas, wt. per cent	4.3	9.6	7.0	11.8	10.2	13.0
Hydrogen, s.c.f. per bbl.	1,200	1,460	1,010	1,110	675	710
10-lb. gasoline:						
Oct. No., research, clear	90	100	90	100	90	95
Yield, vol. per cent	106.5	93.6	100.8	83.2	87.8	81.6



Platforming

THE U.O.P. Platforming process is the pioneer reforming process successfully employing a platinum-containing catalyst to produce high-octane-number motor fuels or aviation-gasoline components from refinery naphthas of much lower octane number. The process also will produce high yields of aromatic concentrates from select naphtha cuts for subsequent recovery. Two improved catalysts have recently become available which are specifically tailored for use in the production of 98 and higher leaded research octane-number gasolines.

Platforming is carried out at temperatures ranging from 850° to 1,000° F. and pressures of 200 to 700 psi. In general, the lower ranges of pressure are used for production of aromatics, while intermediate and higher pressures are employed for octane improvement.

Process reactions . . . Six principal reactions occur simultaneously during Platforming, including: (1) dehydrogenation of C_6 ring naphthenes; (2) isomerization of other naphthenes and their dehydrogenation to aromatics; (3) dehydrocyclization of paraffins; (4) hydrocracking; (5) isomerization of paraffins, and (6) desulfurization.

The accompanying flow diagram illustrates typical equipment and arrangement for Platforming naphtha to produce high-octane motor fuel.

For an aviation-gasoline blending stock the reformate may be rerun in addition to being stabilized. For aromatics recovery, it is suggested that the reformate be charged to a Udex unit.

The data shown in Table 1 were obtained from the commercial Platforming in a standard unit of a Kuwait naphtha, one of the most difficult stocks to upgrade to 102 leaded research octane number. The run lasted over 200 days before lack of charge stock, as a result of the Suez crisis, forced the unit to shut down.

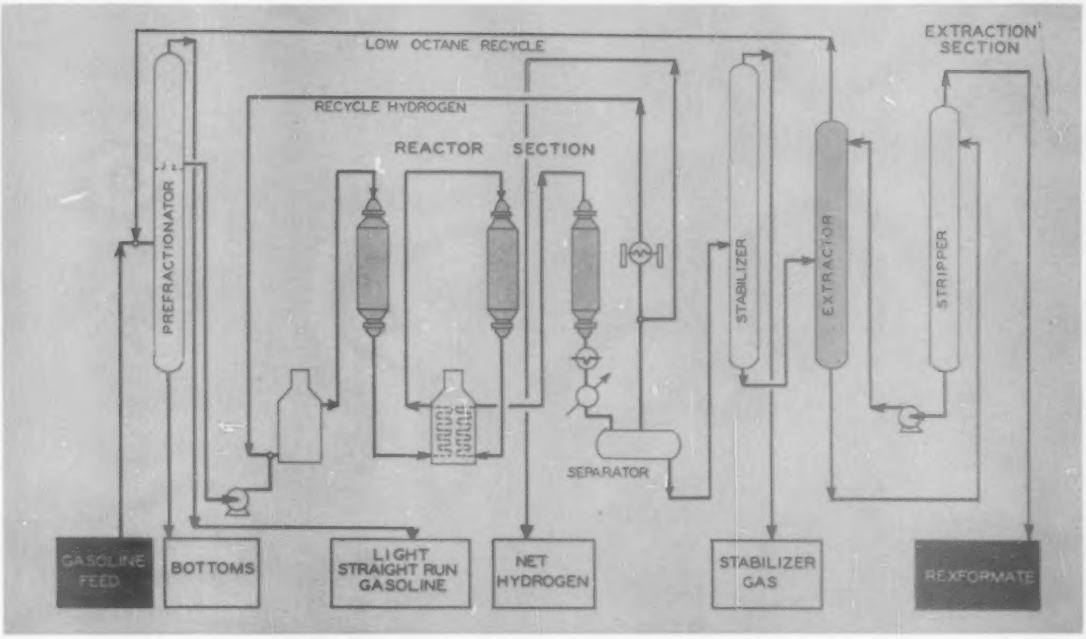
Average yield of 6-lb. R.v.p. reformate during the run was 75 volume per cent of reactor charge. Catalyst age reached 41 in this high severity operation, data for which indicate extreme stability with no evidence of catalyst fouling or excessive hydrocracking. The operator plans to resume high severity operations with the same catalyst when charge stock is again available.

This process is licensed by Universal Oil Products Co.

COMMERCIAL PLATFORMING OF KUWAIT NAPHTHA

	Charge*	Product†
Gravity, °A.P.I.	58.2	51.3
A.S.T.M. distillation, °F.:		
I.b.p.	215	100
10 per cent	232	138
30 per cent	248	188
50 per cent	264	238
70	291	283
90 per cent	318	327
End point	349	390
Reid vapor pressure, psi.	....	6.4
Sulfur, wt. per cent	0.04	Nil
Hydrocarbon type analysis, LV per cent:		
Paraffins	64	....
Olefins	Trace	....
Naphthenes	23	....
Aromatics	13	49
Average yield of 95 oct.:		
Clear reformate	....	....
6-lb. R.v.p., LV per cent on charge	....	75.0
Research octane ratings:		
Clear	....	95.3
With 3 ml. TEL per gal	....	102

*Depentanized. †Stabilized.



Rexforming

THE U.O.P. Rexforming process combines elements of both Platforming and Udex solvent extraction processes to make a reformate testing above 100 unleaded research octane number from full-boiling-range gasoline. The low-octane paraffinic raffinate is continuously recycled with fresh feed. Processing is considered of moderate severity and high-purity aromatics are not recovered as such.

The process flow is labeled to indicate the combination of Platforming and Udex processes. A feature of the process is that the solvent extraction conditions can be adjusted to include desired amounts of low-boiling paraffins and naphthenes in the reformate, along with the aromatics, to help produce a well-balanced motor fuel.

Table 1 illustrates the Rexforming of a West Texas straightrun naphtha in contrast with such a refractory stock as a Middle East naphtha.

Table 2 shows estimated investment and operating costs for a 5,000-bbl. per stream day unit processing a full-boiling-range Mid-Continent gasoline.

Three units are in commercial operation in the United States—the 5,500-bbl. unit of Aurora Gasoline Co. at Detroit, the 3,800-bbl. unit of Cosden Petroleum Corp. at Big Spring, Tex., and the 6,000-bbl. unit of Cities Service Oil Co. (Del.) at Ponca City, Okla.

The Rexforming process was originated and developed by Universal Oil Products Co., which licenses the process.

TABLE 1—REXFORMING OF LOW-OCTANE NAPHTHAS

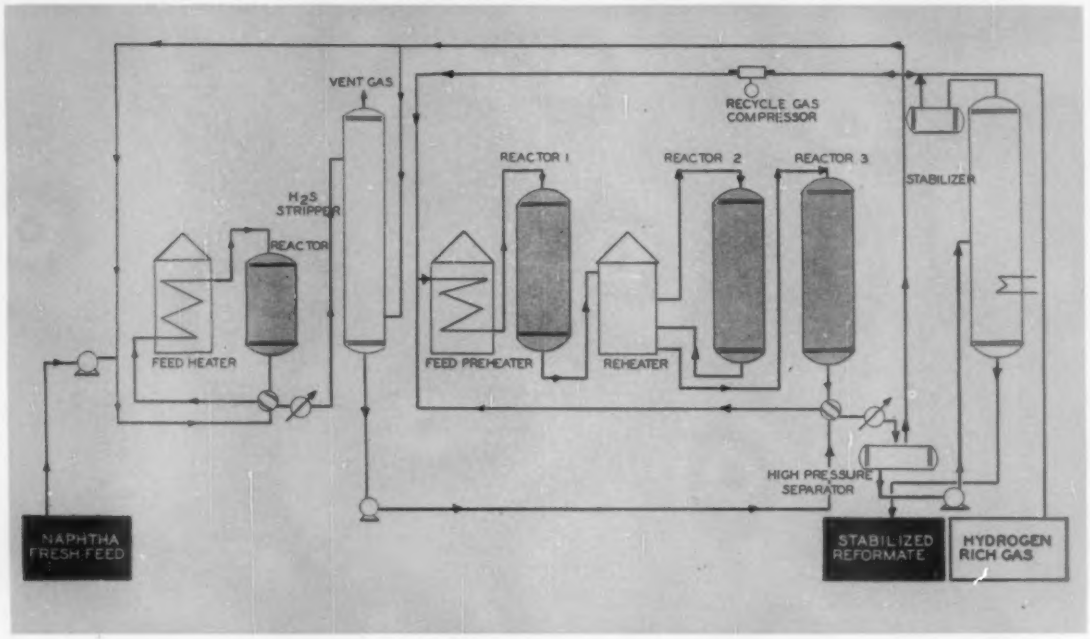
	West Texas*		Middle Eastern†	
	Reactor charge	Reformate‡	Reactor charge	Reformate‡
Gravity, °A.P.I.	56.4	....	57.4	45.4
100 ml. dist., °F.:				
I.b.p.	168	149	204	121
10 per cent	184	184	236	163
30 per cent	214	....	259	230
50 per cent	244	258	282	275
70 per cent	286	....	304	304
90 per cent	328	338	334	345
End point	390	394	386	418
Research clear octane	52.5	§98.2	....	98.0
Aromatics vol. per cent	9.7	64.2	12	58.8
Naphthenes, vol. per cent	36.1	....	19	....
Yields, charge basis: Liq. vol., per cent charge:				
Debutanized reformate	....	79.0	....	75.6
10 lb. R.v.p. reformate	....	....	....	84.7

*Commercial operation. †Pilot plant. ‡Properties and yields are for debutanized reformate except for 10-lb. R.v.p. gasoline yield. §Wiese octane scale extension; 103.4 with 3 ml. TEL/gal.

TABLE 2—ESTIMATED CONSTRUCTION AND OPERATING COSTS, 5,000-BBL. PER STREAM DAY UNIT

Erected cost (within battery limits)*	$1,950,000
Operating costs:	Cents/bbl.
Labor at $2.75 an hour	4.2
Laboratory	1.0
Utilities:	
Fuel at 25 cents per M.M. B.t.u.	†14.3
Power at 0.8 cent per kw.-hr.	1.6
Steam at 50 cents per 1,000 lb.	2.7
Water at 1 cent per 1,000 gal.	1.3
Catalyst	5.0
Solvent	1.6
Maintenance, labor and material‡	3.2
Insurance and property taxes§	2.1
Total operating costs¶	37.0

*4,300 bbl. per stream day fresh naphtha charge to reactor section. †No credit taken for fuel gas make. ‡Three per cent of investment per year. §Two per cent of investment per year. ¶Excludes royalty, depreciation, administration, and overhead.



Houdriforming

HOUDRIFORMING is a fixed-bed catalytic reforming process charging straightrun and cracked petroleum naphthas to produce aviation blending stocks, aromatics, and motor gasolines in the 80-100 F-1 clear range, depending upon feed-stock composition and type or severity of operation.

The Houdry 3-D platinum-content catalyst developed for Houdriforming fulfills exacting requirements for strength, activity, and selectivity,

Process characteristics . . . Outstanding characteristics of Houdriforming may be summarized as follows:

1. Naphthas with end boiling points up to 400° F. may be charged.

2. It is possible to upgrade low-octane straightrun naphthas by 40 to 70 octane numbers, with impressively high liquid volume recovery.

3. With the "guard case" integrated on the process line, high-sulfur stocks are readily handled without resort to scrubbing of recycle gases, and stabilized reformate requires no further treatment before blending.

4. Houdriforming straightrun naphthas in production of aromatics converts naphthenes to benzene, toluene, and xylenes at yields approaching 100 per cent of theoretical values, with significant aromatization of paraffins.

5. In motor gasoline operation, Houdriforming produces large volumes of hydrogen of high purity, recoverable for use in other refinery processes.

Twenty-one Houdriforming units are now on stream or under construction, with a combined design capacity of 168,040 bbl. per stream day.

The accompanying table presents yield data when using the new Houdry 3-D catalyst, with improved activity and stability characteristics.

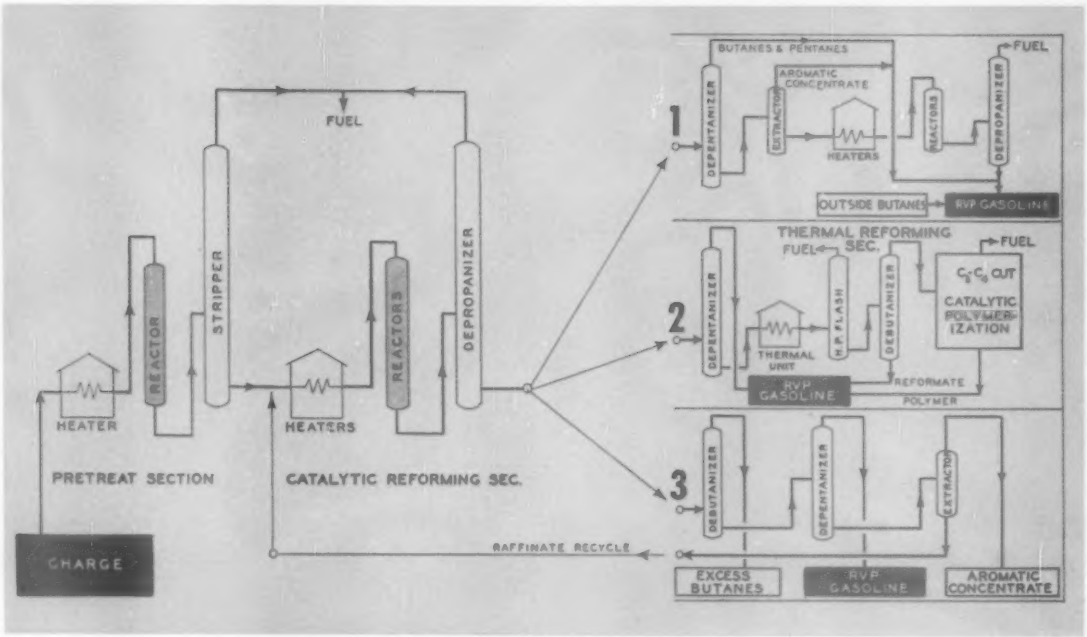
TABLE 1 — HOUDRIFORMING: TYPICAL OPERATING CONDITIONS

Temperature, °F.	875-980
Pressure, psig.	250-600
Space velocity, v./hour/v.	1.5-5.0
Hydrogen—oil mole ratio	4-10

TABLE 2—HOUDRIFORMING OPERATIONS FOR MOTOR GASOLINE PRODUCTS

Charge stock—	Low-paraffin-content-naphtha from mixed-naphthenic crudes		Intermediate paraffin-content naphtha from East Texas crude		High-paraffin-content naphtha from Kuwait crude	
Gravity, °A.P.I.	45.8		55.3		52.9	
F-1 clear octane	61.3		55.6		23.5	
Sulfur, weight per cent	0.012		0.006		0.10	
	Operation		Operation		Operation	
Houdriforming data—	Mild	Severe	Mild	Severe	Mild	Severe
Yields, based on charge:						
Debutanized reformate, vol. per cent	89	81.4	91.7	84.3	88.3	81.1
Debutanized reformate:						
F-1 clear octane	92.0	*101.0	80.0	92.0	76.8	90.0
F-1 + 3 cc. TEL	99.2	*104.2	92.5	99.5	91.0	98.3
Gravity, °A.P.I.	39.9	36.6	53.0	46.0	51.0	47.8
Sulfur, weight per cent	0.002	0.002	<0.001	0.002	<0.001	<0.001

*Octanes above 100 are extrapolated by method of Deters, J. F., Pet. Ref., Vol. 30, No. 6 (June 1951).



Iso-Plus Houdriforming

ISO-PLUS HOUDRIFORMING couples conventional catalytic Houdriforming with supplemental thermal reforming or aromatics extraction to convert low-octane naphthas into gasoline in the range of 100 octane and higher, F-1 clear, at high yield levels.

Commercial runs of Iso-Plus Houdriforming in the thermal reforming alternative have produced motor gasoline of 104 octane, F-1 clear.

Experimental runs of Iso-Plus aromatics extraction variations have produced yields of 100-octane F-1 clear gasoline amounting to 91 per cent of naphtha charge. With slight operational modifications, one aromatics extraction variation has produced 82 volume per cent of charge as 108-octane gasoline, F-1 clear. An aromatics extraction unit will be coupled to the world's largest (45,000 bbl. per stream day) Houdriformer now on stream to produce motor fuel in the 100-plus octane range.

Catalyst . . . Each of the alternatives begins with Houdry "guard case" pretreatment of charge, and proceeds with mild conventional catalytic Houdriforming.

As shown in the flow diagram, Iso-Plus Houdriforming with supplemental thermal reforming adds the cat-poly gasoline from the thermal reformer off-gas olefins to achieve the maximum yield of product at the 100 F-1 clear octane levels.

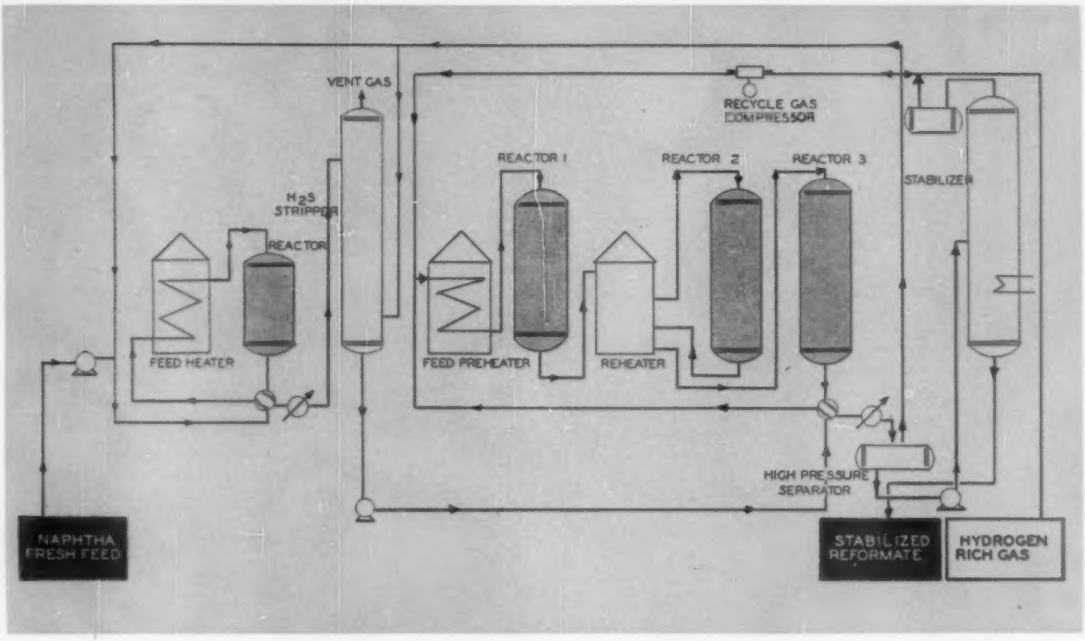
In the aromatics extraction variations, Iso-Plus processing may employ either separate Houdriforming installations with the second reforming unit handling raffinate from aromatics extraction, or a single three-chamber Houdriformer with a mixed feed consisting of naphtha charge and recycled raffinate from the extraction unit.

Table 1 presents comparative yields by two routes in Iso-Plus Houdriforming charging a 200°-394° F. naphtha containing 46 per cent paraffins.

TABLE 1—COMPARATIVE YIELDS AND PROCESS STREAMS OF ISO-PLUS HOUDRIFORMING PROCESSES

	Houdriforming plus aromatics extraction		Houdriforming plus thermal reforming
Feed to pretreater (B/SD)	6,600	6,600	6,600
Recycle raffinate	.....	3,531	.....
Total reformer feed	6,600	10,131	6,600
Yields from reforming:			
Reformate, C_5+	5,003	8,753	5,900
Butanes	271	574	271
Fuel gas, F.O.E.	422	818	422
Reformate octane, F-1 clear	87.0	83.0	87.0
Charge to debutanizer	.....	9,327	6,171
Charge to dependanizer	6,171	7,068	.....
Dependanizer bypass stream	.....	1,685	.....
Extraction charge	5,603	6,545	.....
Aromatic concentrate	3,174	3,014	.....
Raffinate	2,429	3,531	.....
Yields from second pass reforming:	Houdriform raffinate		Thermal reform reformate
Reformate, C_5+	1,932	.....	4,807
Heavy polymer	.....	.....	33
Butanes	246	.....	143
Butenes, recovered for cat. poly chg.	.....	.....	273
Propene, recovered for cat. poly chg.	.....	.....	183
Fuel gas, F.O.E.	293	.....	491
Reformate octane, F-1 clear	81.0	.....	99.6
Catalytic polymer gasoline	.....	.....	328
Over-all yields:			
Butane free gasoline	5,403	5,222	5,135
Butanes for 10-lb. R.v.p.	590	529	536
Total 10-lb. R.v.p. gasoline	5,993	5,751	5,671
Excess butanes	*73	45	*122
Fuel gas, F.O.E.	715	818	913
F-1 clear octane of 10-lb. R.v.p. gasoline	100.0	100.0	100.0

*Outside butanes required.



Houdriforming

HOUDRIFORMING is a fixed-bed catalytic reforming process charging straightrun and cracked petroleum naphthas to produce aviation blending stocks, aromatics, and motor gasolines in the 80-100 F-1 clear range, depending upon feed-stock composition and type or severity of operation.

The Houdry 3-D platinum-content catalyst developed for Houdriforming fulfills exacting requirements for strength, activity, and selectivity,

Process characteristics . . . Outstanding characteristics of Houdriforming may be summarized as follows:

1. Naphthas with end boiling points up to 400° F. may be charged.

2. It is possible to upgrade low-octane straightrun naphthas by 40 to 70 octane numbers, with impressively high liquid volume recovery.

3. With the "guard case" integrated on the process line, high-sulfur stocks are readily handled without resort to scrubbing of recycle gases, and stabilized reformate requires no further treatment before blending.

4. Houdriforming straightrun naphthas in production of aromatics converts naphthenes to benzene, toluene, and xylenes at yields approaching 100 per cent of theoretical values, with significant aromatization of paraffins.

5. In motor gasoline operation, Houdriforming produces large volumes of hydrogen of high purity, recoverable for use in other refinery processes.

Twenty-one Houdriforming units are now on stream or under construction, with a combined design capacity of 168,040 bbl. per stream day.

The accompanying table presents yield data when using the new Houdry 3-D catalyst, with improved activity and stability characteristics.

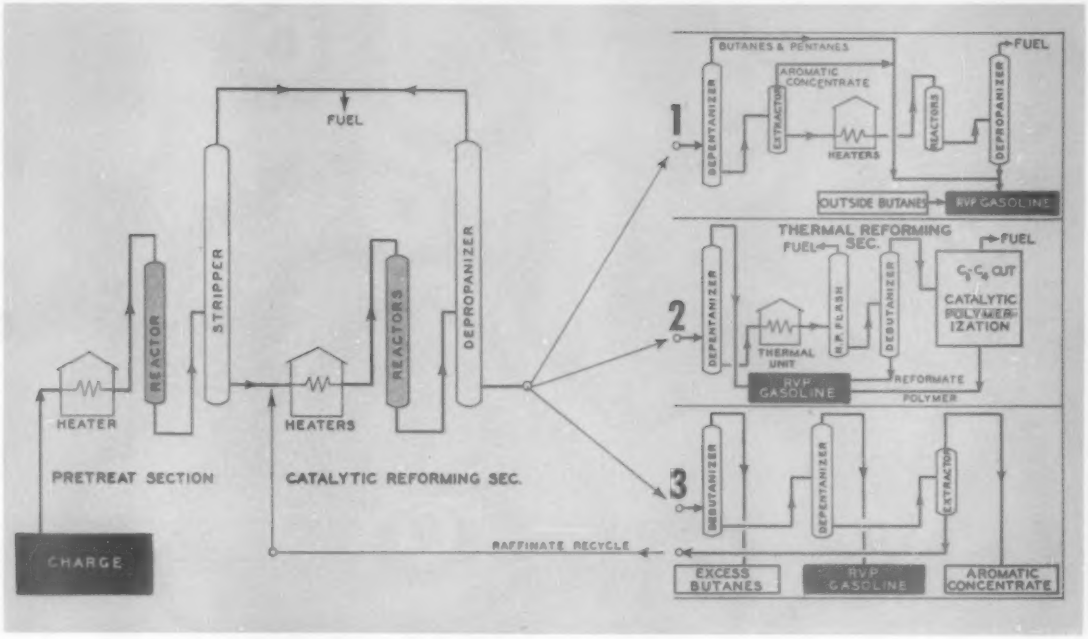
TABLE 1—HOUDRIFORMING: TYPICAL OPERATING CONDITIONS

Temperature, °F.	875-980
Pressure, psig.	250-600
Space velocity, v./hour/v.	1.5-5.0
Hydrogen—oil mole ratio	4-10

TABLE 2—HOUDRIFORMING OPERATIONS FOR MOTOR GASOLINE PRODUCTS

	Low-paraffin-content-naphtha from mixed-naphthenic crudes		Intermediate paraffin-content naphtha from East Texas crude		High-paraffin-content naphtha from Kuwait crude	
Charge stock—						
Gravity, °A.P.I.	45.8		55.3		52.9	
F-1 clear octane	61.3		55.6		23.5	
Sulfur, weight per cent	0.012		0.006		0.10	
	Operation		Operation		Operation	
Houdriforming data—	Mild	Severe	Mild	Severe	Mild	Severe
Yields, based on charge:						
Debutanized reformate, vol. per cent	89	81.4	91.7	84.3	88.3	81.1
Debutanized reformate:						
F-1 clear octane	92.0	*101.0	80.0	92.0	76.8	90.0
F-1 + 3 cc. TEL	99.2	*104.2	92.5	99.5	91.0	98.3
Gravity, °A.P.I.	39.9	36.6	53.0	46.0	51.0	47.8
Sulfur, weight per cent	0.002	0.002	<0.001	0.002	<0.001	<0.001

*Octanes above 100 are extrapolated by method of Deters, J. F., Pet. Ref., Vol. 30, No. 6 (June 1951).



Iso-Plus Houdriforming

ISO-PLUS HOUDRIFORMING couples conventional catalytic Houdriforming with supplemental thermal reforming or aromatics extraction to convert low-octane naphthas into gasoline in the range of 100 octane and higher, F-1 clear, at high yield levels.

Commercial runs of Iso-Plus Houdriforming in the thermal reforming alternative have produced motor gasoline of 104 octane, F-1 clear.

Experimental runs of Iso-Plus aromatics extraction variations have produced yields of 100-octane F-1 clear gasoline amounting to 91 per cent of naphtha charge. With slight operational modifications, one aromatics extraction variation has produced 82 volume per cent of charge as 108-octane gasoline, F-1 clear. An aromatics extraction unit will be coupled to the world's largest (45,000 bbl. per stream day) Houdriformer now on stream to produce motor fuel in the 100-plus octane range.

Catalyst . . . Each of the alternatives begins with Houdry "guard case" pretreatment of charge, and proceeds with mild conventional catalytic Houdriforming.

As shown in the flow diagram, Iso-Plus Houdriforming with supplemental thermal reforming adds the cat-poly gasoline from the thermal reformer off-gas olefins to achieve the maximum yield of product at the 100 F-1 clear octane levels.

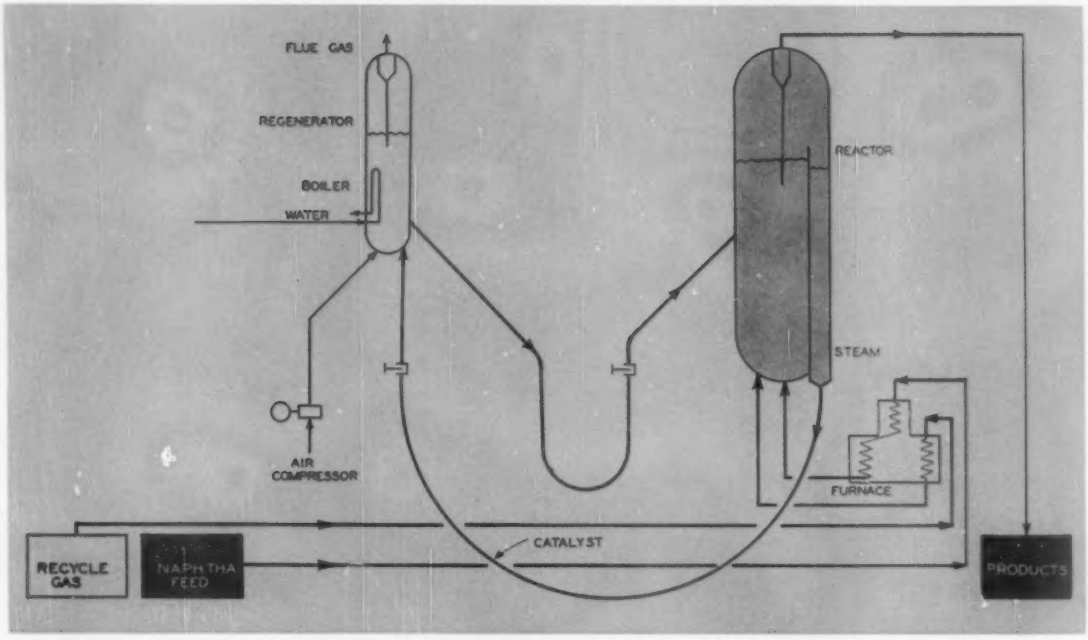
In the aromatics extraction variations, Iso-Plus processing may employ either separate Houdriforming installations with the second reforming unit handling raffinate from aromatics extraction, or a single three-chamber Houdriformer with a mixed feed consisting of naphtha charge and recycled raffinate from the extraction unit.

Table 1 presents comparative yields by two routes in Iso-Plus Houdriforming charging a 200°-394° F. naphtha containing 46 per cent paraffins.

TABLE 1—COMPARATIVE YIELDS AND PROCESS STREAMS OF ISO-PLUS HOUDRIFORMING PROCESSES

	Houdriforming plus aromatics extraction		Houdriforming plus thermal reforming
Feed to pretreater (B/SD)	6,600	6,600	6,600
Recycle raffinate	....	3,531	....
Total reformer feed	6,600	10,131	6,600
Yields from reforming:			
Reformate, C_5+	5,003	8,753	5,900
Butanes	271	574	271
Fuel gas, F.O.E.	422	818	422
Reformate octane, F-1 clear	87.0	83.0	87.0
Charge to debutanizer	....	9,327	6,171
Charge to depentanizer	6,171	7,068	....
Depentanizer bypass stream	....	1,685	....
Extraction charge	5,603	6,545	....
Aromatic concentrate	3,174	3,014	....
Raffinate	2,429	3,531	....
Yields from second pass reforming:	Houdriform raffinate		Thermal reform reformate
Reformate, C_5+	1,932	....	4,807
Heavy polymer	....	....	33
Butanes	246	....	143
Butenes, recovered for cat. poly chg.	....	....	273
Propene, recovered for cat. poly chg.	....	....	183
Fuel gas, F.O.E.	293	....	491
Reformate octane, F-1 clear	81.0	....	99.6
Catalytic polymer gasoline	....	....	328
Over-all yields:			
Butane free gasoline	5,403	5,222	5,135
Butanes for 10-lb. R.v.p.	590	529	536
Total 10-lb. R.v.p. gasoline	5,993	5,751	5,671
Excess butanes	*73	45	*122
Fuel gas, F.O.E.	715	818	913
F-1 clear octane of 10-lb. R.v.p. gasoline	100.0	100.0	100.0

*Outside butanes required.



Fluid Hydroforming

FLUID HYDROFORMING is a flexible, fully continuous process for converting virgin and cracked naphthas to high-octane gasoline. Using the fluidized solids technique, it employs a molybdena-alumina catalyst. At present, 115,000 bbl. per day of capacity is being installed in the United States and abroad.

A great variety of feed stocks has been reformed to products in the 90 to 100-octane number range. Both narrow and wide-cut feeds have been processed. There is no limitation on feed end point, and feeds containing cracked stocks can be reformed with excellent yields with pretreatment for olefin saturation or sulfur removal.

The catalyst is cheap and rugged and not susceptible to poisoning by sulfur or water. The products are essentially sulfur free. Selectivity of the catalyst does not fall off with continued use.

Operation . . . The finely divided catalyst, behaving much like a fluid, circulates continuously between the reactor and the regenerator. The preheated naphtha feed enters the bottom of the reactor where it meets a hot isothermal bed of catalyst. The reformed products leave the catalyst bed and pass through separators where entrained catalyst is removed and returned to the bed. The overhead products are heat exchanged, cooled and separated into gaseous and liquid products.

After stabilization, the liquid product is removed as high-octane gasoline. A portion of the gaseous product is compressed, heated, and recycled to the reactor to supply additional heat.

To eliminate carbon which deposits on the catalyst during the reaction, a portion is continuously withdrawn and allowed to flow to the regenerator. Here carbon is burned off with air which liberates large quantities of heat. The heat may be used to produce steam or preheat the feed. The hot regenerated catalyst returns as a fluidized stream to the reactor, supplying some of the heat required and completing the continuous cycle.

Yields from Fluid Hydroforming at any octane level depend on the feed-stock quality.

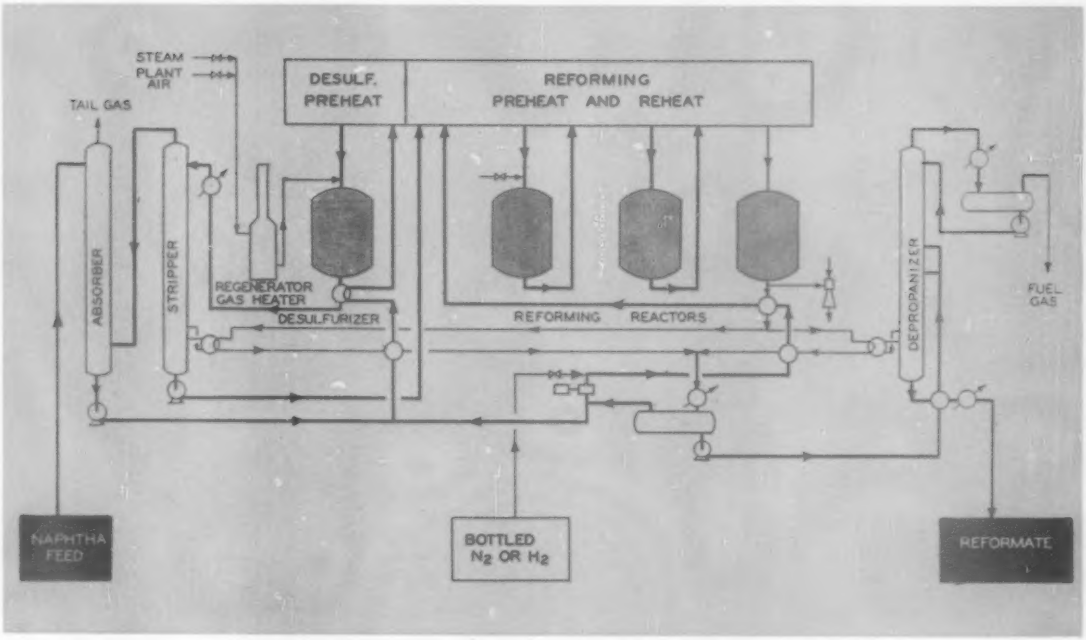
Ten Fluid Hydroforming units with a total capacity of 114,230 bbl. per day have been built or are now under construction. Four of these are licensed units.

The Fluid Hydroforming process was developed and is being licensed by Esso Research & Engineering Co., New York.

TABLE 1

Hydroforming of a 250° to 325° F. West Texas Virgin Naphtha to Produce a 92-Octane Number (A.S.T.M. D 908, Research Method) C_5+ Gasoline Without TEL Addition

Reactor:	Model I
Pressure, psig.	200
Temperature, °F.	895
Recycle gas:	
Rate, cu. ft. per bbl.	4,700
Preheat temperature, °F.	1,200
Naphtha:	
Preheat temperature, °F.	1,000
Solids circulation, lb. per lb. of naphtha feed:	
Catalyst (catalyst-to-oil ratio)	1.0
Regenerator:	
Pressure, psig.	200
Temperature, °F.	1,125
Cooling-coil duty, B.t.u. per lb. of feed	100
Air standard, cu. ft. per bbl. of feed	541



Cat Reforming and Desulfurization

IN this combination process, designed by M. W. Kellogg Co., byproduct hydrogen from the reforming reactions is combined catalytically with sulfur compounds in the naphtha feed, to produce hydrogen sulfide which is removed from the system with tail gas.

This combination process permits an unusually high yield-octane relationship at low utility consumption.

The process is readily adaptable to low-grade-naphtha feed stocks. The feed-preparation section may be designed to remove sulfur, metals, and water, all to trace levels. Thermally cracked naphthas can be charged directly to the unit.

High yields . . . Yields of high-octane reformates derived from Kuwait (or highly paraffinic naphthas) are only slightly lower than those from higher-grade Mid-Continent feed stocks. This is shown in Table 1. For example, the volume per cent yields of 95 clear octane C_5+ reformates derived from Kuwait and Mid-Continent naphthas differ by less than 3 per cent.

The catalyst has unusually long life, due to its regenerative feature, and it has high paraffin dehydrocyclization activity. This predominant conversion of paraffins to aromatics provides for increased liquid yield. Thus octane number is raised while a low-volatility product is maintained.

This process yields release gas which is unusually rich in hydrogen, as shown in Table 1. This is a decided economic advantage in over-all refinery operation.

The typical naphtha reforming process employs three catalyst bed adiabatic reactors arranged in series. Regeneration is carried out in blocked-out operation.

The process utilizes a platinum catalyst developed by Sinclair Research Laboratories and Baker & Co. Over 300,000 bbl. of capacity has been contracted or is anticipated utilizing the Sinclair-Baker catalyst.

Examples of process economics are shown in Table 2.

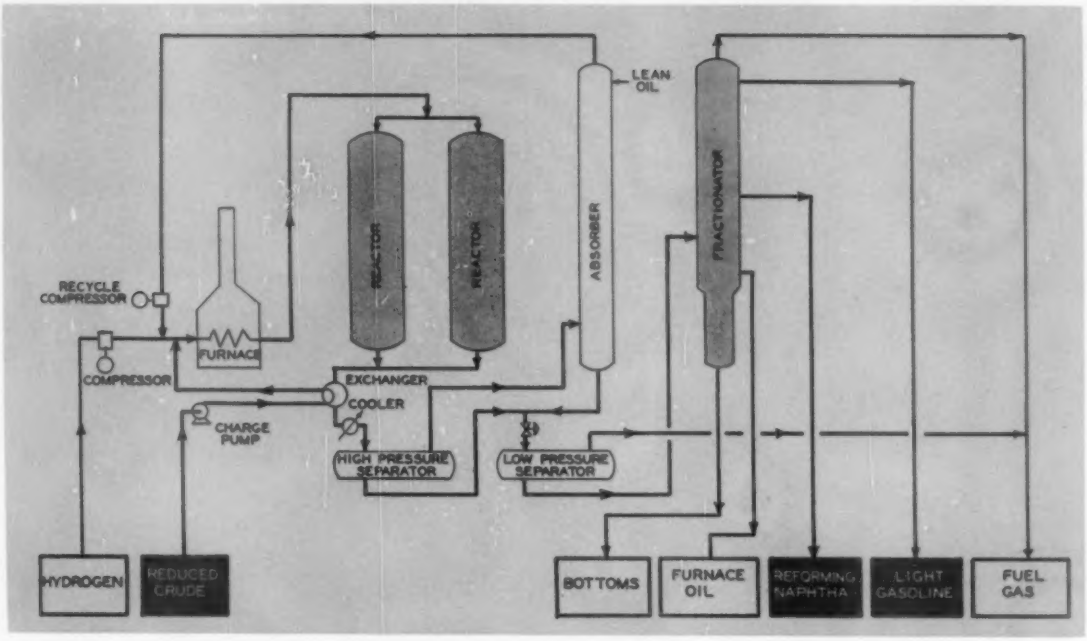
TABLE 1—PERFORMANCE DATA

Research clear O.N.	90	95	97
Yield, volume per cent on feed:			
10-lb. R.v.p. Mid-Continent reformate	97	94	92
C_5+ Mid-Continent reformate	86	83	81
10-lb. R.v.p. Kuwait reformate	95	91	88
C_5+ Kuwait reformate	84	81	78
Hydrogen production, std. cu. ft./bbl.:			
Mid-Continent	1,130	1,270	1,320
Kuwait	730	860	910

TABLE 2—OPERATING COST SUMMARY

(10,000-bbl. per stream day unit making 95 research octane number of C_5+ clear costs in cents per barrel)

	Kuwait	Mid-Continent
Fuel ($0.90 per bbl.)	5.2	5.2
Power ($0.007 per kw.-hr.)	2.3	2.0
Water ($0.007 per 1,000 gal.)	0.6	0.5
Catalyst:		
Reforming	9.2	6.1
Desulfurization	0.5	0.5
Labor ($55.00 per day)	1.7	1.4
Supervision (15 per cent labor)	0.2	0.2
Total direct operating cost (cents per bbl.)	19.7	15.9
Maintenance (4 per cent process equip. invest.)	2.8	2.5
Property taxes and insurance (2 per cent process invest.)	2.0	1.8
Interest (4 per cent total process invest.)	4.0	3.6
Depreciation (10 per cent process equip. invest.)	6.7	6.3
Total operating cost (cents per bbl.)	35.2	30.1



Gulf HDS Process

THE Gulf HDS process is an intermediate-pressure hydrogenation process which effectively desulfurizes whole crude oil and residual fractions of crude oils and under appropriate conditions hydrocracks varying proportions of the crude to lower boiling products.

Although a standard catalyst is available for processing a wide variety of stocks, modified catalysts are desirable in some applications and may be one of several metallic compound-supported catalysts. The catalyst is usually supplied with ⅜-in. pellets which have a bulk density of 50-55 lb. per cu. ft. and are extremely rugged.

In addition, the standard material maintains its activity in the presence of high-metal-content heavy crude oils and residual stocks. The time required for regeneration of the catalyst depends on the established reactor cycle and the deposits on the catalyst. The replacement varies with the operating conditions required for the feed stock being processed, with normal life estimated to be 2 or more years.

Process flow . . . As diagramed by the flow sheet, feed together with the hydrogen makeup and recycle gas is heated to desired reaction temperature in furnace.

The reactor effluent, after being cooled in exchangers, enters the high-pressure flash drum where the rich gas is flashed off, as feed to the absorber tower. Condensate goes to the low-pressure drum where it combines with the rich oil from the absorber.

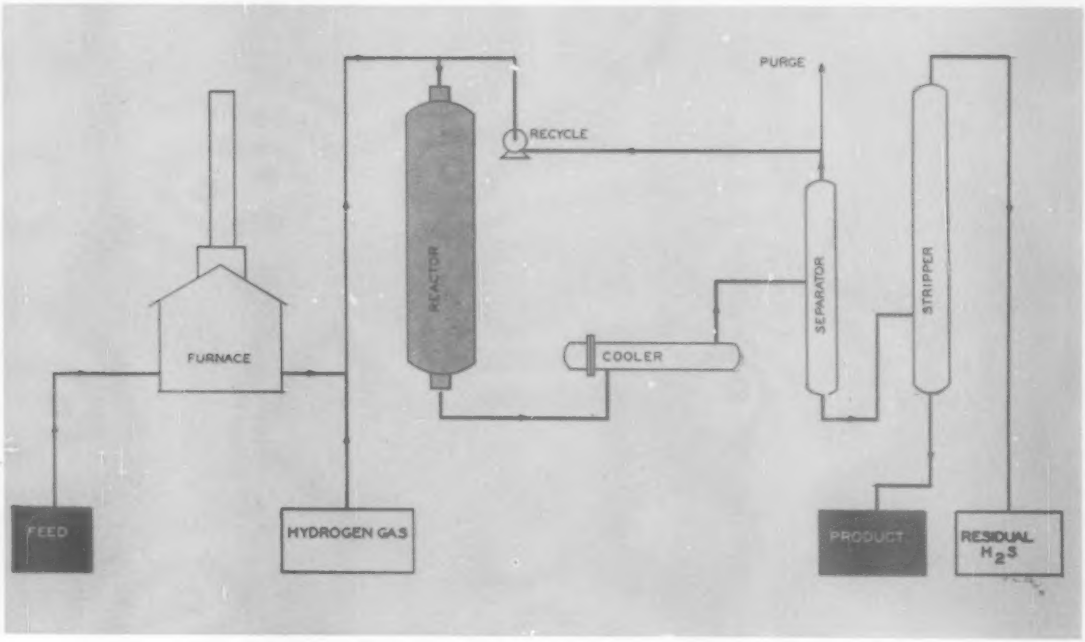
Liquid from the low-pressure drum is fed to the fractionator tower for separation of the desired products. Further details may be found in The Oil and Gas Journal, May 16, 1955, page 196.

The selection of operating variables is a function of the charge stock being processed. Temperature is normally maintained in the range of 750°-850° F. Pressure is usually between 500 and 1,000 psig. Suitable desulfurization can usually be obtained at space velocities in the range of 0.5 to 2.0 vol./hr./vol. The recycle gas rate is controlled between 2,500 and 5,000 std. cu. ft. per bbl. and its hydrogen concentration is normally maintained above 65 per cent. Process periods between regenerations vary in length from 0.5 to 30 days.

Typical operating expenses and investment costs are included in Table 1, which has been prepared by M. W. Kellogg Co. Although a number of applications appear promising, no commercial units have been installed to date. Further inquiries should be directed to the licensing agent, M. W. Kellogg Co.

TABLE 1—GULF HDS PROCESS—YIELDS, UTILITIES, PERFORMANCE AND INVESTMENTS

	Vacuum bottoms, Kuwait residues		Mid-Continent vac. tar	Great Lakes blend
Charge stock:				
Rate, B/SD	3,740		3,300	17,900
Gravity, °A.P.I.	5.8		10.0	17.3
Sulfur, per cent by wt.	5.45		1.2	1.1
Carbon res., Conradson, per cent by wt.	19.8		13.0	5.3
Operating severity:	High	Low		
H_2 consumption, s.c.f./bbl.	1,140	425	645	359
Product:				
Coke, per cent by wt.	6.4	0.6	1.5	1.6
Sulfur, per cent by wt.	5.1	2.5	0.6	0.7
Dry gas, per cent by wt.	6.4	0.9	2.0	2.1
Deprop. liq., °A.P.I.	33.2	15.2	22.9	28.0
Total C_4+, per cent by wt.	82.7	95.8	96.7	92.9
Sulfur, per cent by wt.	0.41	3.08	0.42	0.26
Carbon residue, per cent by wt.	1.09	14.1	...	...
Oct., clr. res., 8-lb. R.v.p. gasoline	48.8	53.1	57	63
Cetane No., 400°-622° F. cut	46	44	41	40
Investment (million dollars):				
React. and regen. sections	7.5	3.1	1.9	6.2
Catalyst inventory	...	...	0.46	2.0



Hydrofining

HYDROFINING is a versatile hydrogenation process used for sulfur removal and the general upgrading of products ranging from gasolines to waxes. Esso Research & Engineering Co. developed the process and licenses it.

Operating conditions are not severe, normally, ranging from 400° to 800° F. and from 50 to 800 psig.

Hydrofining fits naturally into the present trend to high-octane gasolines, in that it makes use of the hydrogen produced in large quantities as a byproduct of catalytic reforming processes.

For platinum-catalyst reforming feeds, sulfur reduction to less than 10 p.p.m. can be achieved. These operations produce 100 per cent volumetric yield, and will run for many months without regeneration.

Uses . . . Hydrofining has been applied to the control of odor, sulfur, and corrosion characteristics of various solvents. For kerosine it achieves desulfurization, improvement of color and odor, and a reduction in wick char. For diesel-fuel stocks, Hydrofining greatly reduces sulfur, improves diesel index and color, and holds carbon residue at a low level.

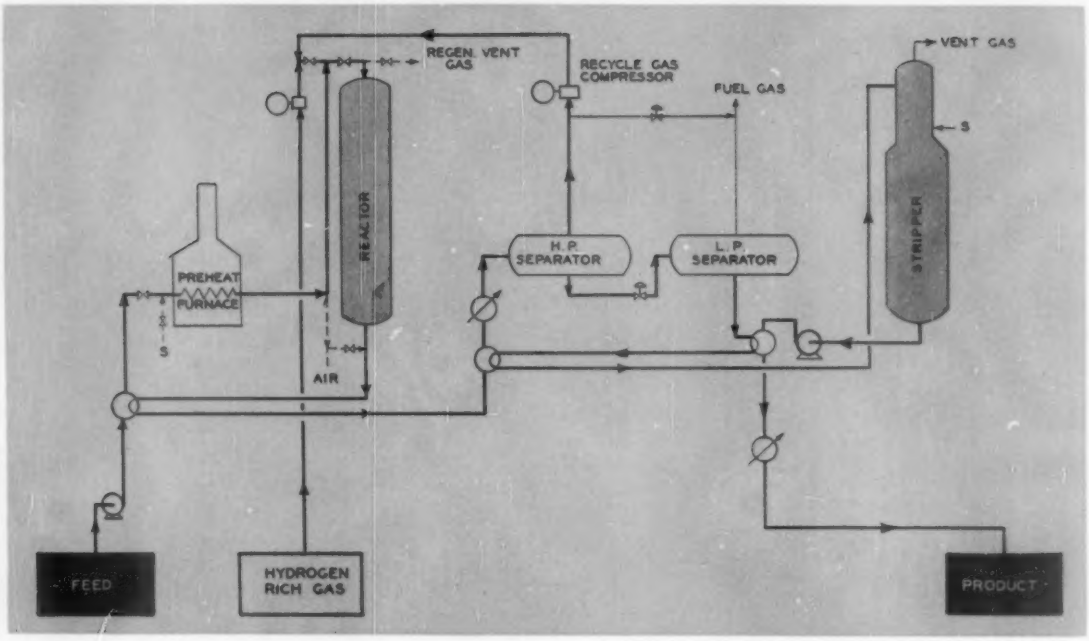
Hydrofining is an extremely effective means of achieving stability and general quality improvement for heating oils, and for upgrading cracked gas oils to heating oils. The process can also be applied to the refining of low-cost lubricants as a replacement for acid treating, or it can be applied as the final process to insure uniformity of color and other properties of lube base stocks prepared by extraction and, where necessary, dewaxing.

The newest use of Hydrofining has been in the steel industry, where the sulfur content of light-oil byproducts from coking operations is reduced to less than 1 p.p.m.

Currently, 36 units with a total capacity of 300,000 bbl. a day are in operation, under construction, or in the design stage. (These figures exclude over 200,000 bbl. a day of Hydrofining capacity for removal of sulfur from feed stocks to catalytic reforming units.)

HYDROFINING DIESEL FUELS

	West Texas (308°-641° F.)			Elk Basin (478°-634° F.)		83% Virgin Arabian 17% catalytic stock (495°-682° F.)	
	Feed	Products		Feed	Product	Feed	Product
Sulfur	0.92	0.15	0.50	1.3	0.25	1.6	0.35
Copper number	92	<1	<1	34	<1	.....	<1
Gravity, °A.P.I.	37.9	38.4	38.4	31.4	33.5	30	32
Aniline point	143	150	145	154	154	151	154
Diesel index	54	58	56	48	52	45	50
Cetane number	.....	53-55	53-55	46	46	51	52
Bromine	.....	.....	.....	.....	.....	10	1
Color, TR	17	17	18	14	22	.....	.....
Carbon residue, 10 per cent	0.03	.....	0.04	0.02	0.02	0.06	0.02



Hydrodesulfurization

STANDARD OIL CO. (INDIANA) hydrodesulfurization process is a versatile method for hydrogen-treating petroleum stocks ranging from naphthas through furnace oils. Depending on the feedstock employed and the results desired, the process may be designed for a wide range of operating pressures. When virgin naphthas or light distillates are treated, lower pressures are employed; higher pressure operation is used on higher boiling distillates or cracked stocks.

The process may be used to lower sulfur and nitrogen content of virgin naphthas and saturate the olefins contained in cracked naphthas charged to catalytic reforming. When applied to heavier distillates, in addition to lowering sulfur and nitrogen content, color, odor, and burning characteristics of product are improved.

The process employs a fixed catalyst bed and operates with a cobalt-molybdenum on alumina catalyst which may be regenerated in place as required.

Process description . . . The flow sheet shows a typical unit designed for moderate or high-pressure operation. Such a unit might typically operate at 500 to 1,000 psig.

Feed is pumped through a heat exchanger to a furnace. The hydrogen-rich gas stream, consisting of compressed makeup gas and of recycle gas from the high-pressure separator, join the naphtha leaving the furnace and the combined stream enters the reactor. Depending on the particular feed and pressure used, the reaction is carried out in the vapor or mixed phase. The reactor effluent is cooled and is flashed in a high-pressure separator to yield a liquid product stream, and a gas stream, part of which is recycled.

Process conditions . . . The process is carried out at temperatures of 600° to 800° F. and pressures of 200 to 1,500 psig. Space velocity ranges from 1 to 20 vol./vol. hr. The hydrogen gas addition rate is from 500 to 4,000 s.c.f. per bbl. The hydrogen concentration of the gas ranges from 65 to 90 volume per cent.

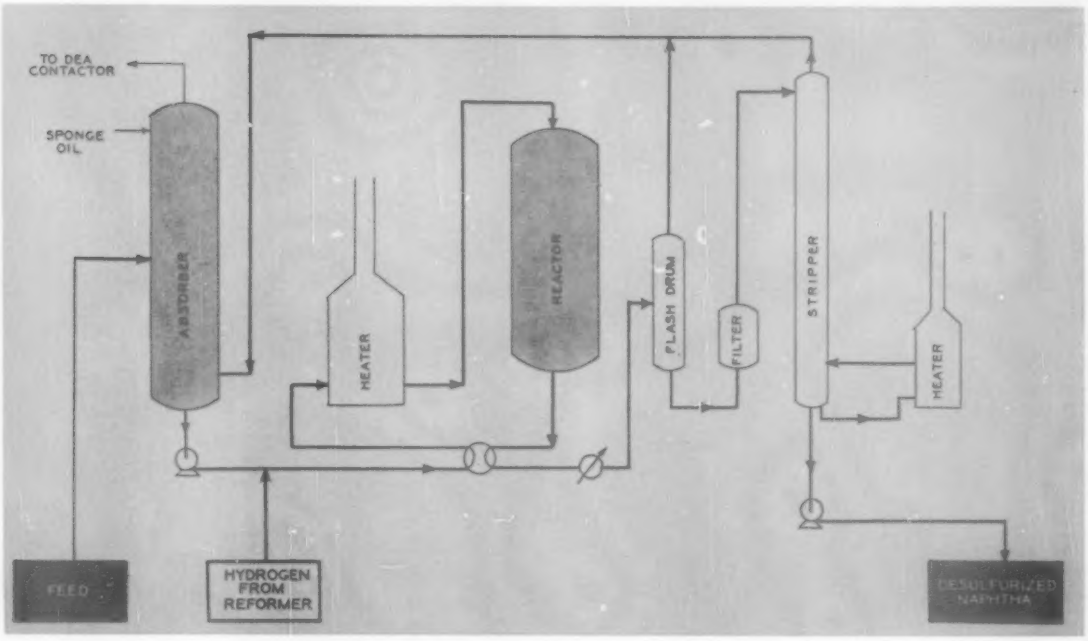
Process performance . . . Typical process performance for three different stocks is shown in Table 1.

Commercial units . . . Twenty units having a combined capacity of over 200,000 bbl. per stream day have been built or planned.

TABLE 1—STANDARD OIL CO. (INDIANA) HYDROGEN-TREATING PROCESS

Typical Process Performances

	60 per cent virgin, 40 per cent coker naphtha		West Texas virgin heater oil		84 per cent catalytic cycle oil, 16 per cent coker gas oil	
Stock—						
Yields, vol. per cent:						
Product	100		98.0		95.5	
Inspections—	Feed	Product	Feed	Product	Feed	Product
Gravity, °A.P.I.	56	57	41	42	31	33
A.S.T.M. dist., °F.:						
I.b.p.	175	170	346	349	368	376
10 per cent	209	207	386	389	426	426
50 per cent	252	251	450	446	494	489
90 per cent	323	325	518	515	560	565
Max.	375	380	552	550	626	631
Sulfur wt. per cent	0.32	0.0030	0.60	0.06	1.10	0.09
Others:						
Nitrogen, wt. per cent	0.0031	0.0006	....	....	....	....
Bromine No.	29	0.5	....	....	....	....
Olefins, vol. per cent	15	1	....	....	....	....
Color, Saybolt	....	....	+25	+27	....	....
Cetane No.	....	....	....	....	36.7	40.8
Gum, A.S.T.M. D-381	....	....	....	....	83	20



Hydrogen Treating (Sinclair)

SINCLAIR REFINING CO.'S hydrodesulfurization process uses a cobalt-molybdenum on alumina catalyst developed by Sinclair Research Laboratories, Inc., in cooperation with the catalyst division of National Aluminate Corp., Chicago.

Unique methods of manufacturing Nalco Type RD-154 catalyst yield a rugged ⅛-in. extrudate with high-surface-area and low-attrition-loss properties.

Regeneration . . . The catalyst normally operates for long periods of time without regeneration being required. When necessary, regeneration is accomplished in 24-72 hours using steam-diluted air to burn carbonaceous deposits. Activity and selectivity of the catalyst are returned to essentially virgin quality.

Important operating variables are temperature, pressure, space velocity, and hydrogen recycle. Temperature ranges from 580°-780° F. During the operating cycle, temperature is usually raised to compensate for decline in catalyst activity. Pressure ranges from 200-800 psig. Space velocity ranges from 2 for high sulfur fluid cycle oil to 10 for straightrun naphthas. Hydrogen recycle ranges from 500 std. cu. ft. per barrel of feed for straightrun naphthas to as high as 5,000 std. cu. ft. per bbl. for cycle oils.

A simplified flow diagram of the reformer feed desulfurization unit located at Houston is shown. This unit processes 24,000 bbl. per day of straightrun naphtha, reducing the sulfur from about 600 to 30 p.p.m. Nitrogen content is reduced from about 10 to less than 1 p.p.m., and the arsenic content is reduced from about 10 to less than 4 parts per billion (p.p.b.). This unit has been on stream for a period of almost 1 year without regeneration. Desulfurization is still better than 90 per cent. First cycle life will be approximately 150 bbl. per pound of catalyst, and ultimate life is expected to be at least 250 bbl. per pound.

Sinclair and others have on stream, or in the planning stage, total desulfurizing capacity of well over 100,000 bbl. per day.

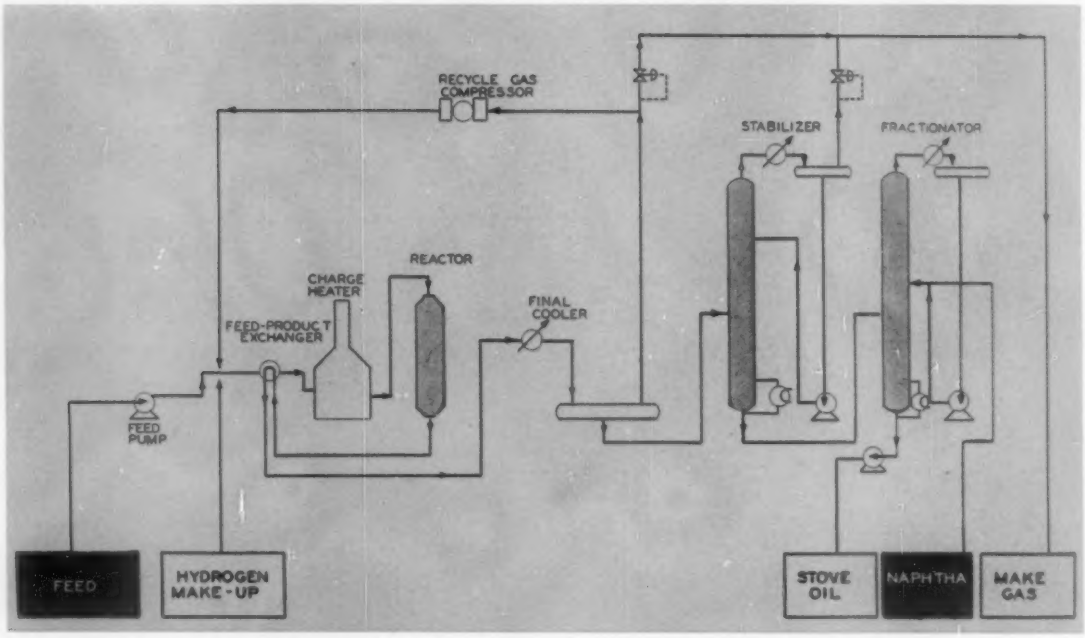
TABLE 1—TYPICAL HYDRODESULFURIZATION APPLICATIONS

	Straightrun naphtha	Virgin heating oil	Fluid cycle oil
Processing conditions:			
Temperature, °F.	700	700	680
Pressure, psig.	250	500	500
Wt.-hr. space velocity	6	4	2
Hydrogen recycle, s.c.f./bbl.	800	1,000	3,500
Hydrogen consumption, s.c.f./bbl.	10	110	180

Inspection tests:	Charge	Product	Charge	Product	Charge	Product
Gravity, °A.P.I.	55.0	55.3	37.4	38.8	25.9	29.2
Sulfur, wt. %	0.060	0.003	0.80	0.05	1.80	0.08
Bromine No.	1.2	0.2	7.0	1.0	24.0	8.0
Nitrogen, p.p.m.	1	0	15	7	30	15
Arsenic, p.p.b.	10	4	...	...	...	...

Typical Operating Expenses—10,000-Bbl. per Day Plant Gulf Coast Location—Treating Straightrun Naphtha

	Cents/bbl.
Labor (including benefits)	2.0
Maintenance (labor and materials)	2.3
Utilities	3.5
Catalyst	0.4
Hydrogen	Negligible
Taxes and insurance	1.2
Total (excluding overhead)	9.4



Unifining (U.O.P.)

THE Unifining process is a versatile means of removing sulfur, nitrogen, oxygen, color bodies, and metal contaminants from petroleum distillates and of saturating olefins. The process may be applied to fractions of wide boiling ranges, from gasoline to heavy distillates. These stocks may be either straightrun or cracked, and of high or low sulfur content.

Process . . . The schematic flow sheet indicates the arrangement for the simultaneous preparation of Platforming feed stock and high-grade stove oil by the processing of coker distillates. The fractionator shown is not required in all applications of the process. The stabilizer likewise may be replaced by a stripper, a rectified absorber, or other equipment as desired to best fit Unifining into a specific refinery process scheme.

The Unifining process operates in vapor or mixed phase at temperatures usually ranging from 500° to 750° F. and pressures of 300 to 800 psi., or higher, the exact conditions depending on the feed stock being processed and the results desired. The special cobalt-molybdenum-type catalyst is extremely rugged, has exceptional activity, and retains this even after operating for extended periods. It is not significantly affected by charge-stock contaminants commonly considered as catalyst "poisons."

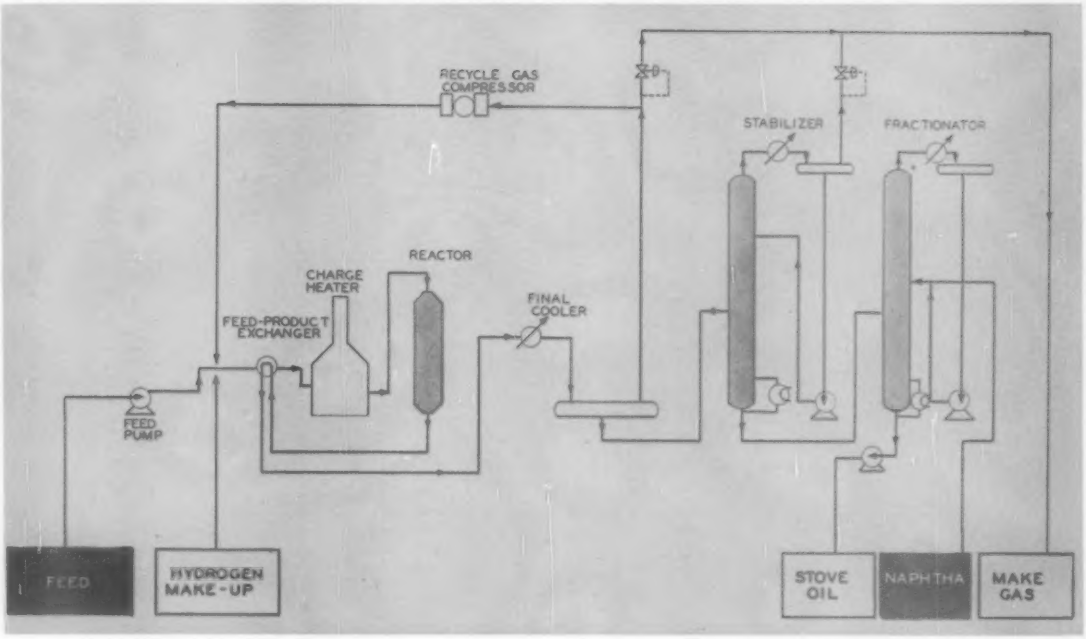
Unifining is essentially a selective hydrogenation process. It is designed to prepare a charge for subsequent processing, such as Platforming or fluid catalytic cracking, and to improve the marketability of such refinery products as stove oil, diesel fuels and unstable distillates.

Commercial installations . . . The first commercial installation was made in 1953. At the present time over 60 units are operating, or are in process of design construction. (A license to use the Unifining process may be secured through either Universal Oil Products Co. or Union Oil Co. of California.)

TABLE 1—RESULTS FROM UNIFINING OF VARIOUS STOCKS

	S.R. naphtha and coker distillate		Wyoming diesel oil		Wyoming light cycle oil		Heavy vacuum gas oil	
Inspection—	Feed	Product	Feed	Product	Feed	Product	Feed	Product
Gravity, °A.P.I.	50.3	50.9	31.3	34.8	19.3	26.3	23.6	27.2
A.S.T.M. distillation, °F.:								
I.b.p.	254	254	452	260	430	395	576	440
10 per cent	280	279	523	492	458	420	674	600
50 per cent	322	327	560	547	483	462	793	760
90 per cent	406	414	603	596	515	508	879	870
End point	456	472	640	644	554	580	*902	*894
Mercaptan S, weight per cent	0.02	Nil	.....	.....	.....	Dr. neg.	.....	.....
Total sulfur, weight per cent	0.11	0.01	2.1	0.14	2.54	0.06	1.94	0.39
Bromine No.	12.9	0.4	.....	.....	21.8	2.7	.....	.....
Basic nitrogen, p.p.m.	25.9	<1	.....	.....	48.0	7.0	.....	.....
Arsenic, p.p.b.	27.0	<1	.....	.....	.....	.....	.....	.....
Cetane No.	.....	.....	46	52	.....	.....	.....	.....
Liquid yield, volume per cent charge	.....	100.0	.....	100.0	.....	100.8	.....	100.4

*97 per cent over.



Unifining (Union Oil Co.)

UNIFINING is a versatile catalytic hydrogenation process for removing sulfur, nitrogen, oxygen, and other contaminants from hydrocarbon feed stocks.

Objectives . . . Unifining accomplishes (1) removal of sulfur and nitrogen, (2) removal of catalytic coke-forming materials, (3) removal of catalytic reforming inhibitors, (4) improvement in gasoline yield and catalytic cracking susceptibility, (5) improvement in lead susceptibility and storage stability, (6) improvement in odor, color, and burning properties of all treated streams.

The accompanying diagram shows an equipment arrangement for the simultaneous preparation of catalytic reformer feed and high-grade stove oil by the processing of coker distillates. The feed is combined with reactor products, and heated to the required reactor inlet temperatures. On passing through the reactor, the desired catalytic reactions are accomplished and these may occur in either vapor-phase or mixed-phase conditions, depending on the specific application.

The reactor products, after heat exchange, are cooled and flow to a high-pressure separator. The hydrogen-rich gas is recycled back to the reactor. Any excess over process requirements is vented to fuel. The high-pressure separator liquid flows to a stabilizer for removal of dissolved light gases and is shown in this figure as a conventional refluxed stabilizer.

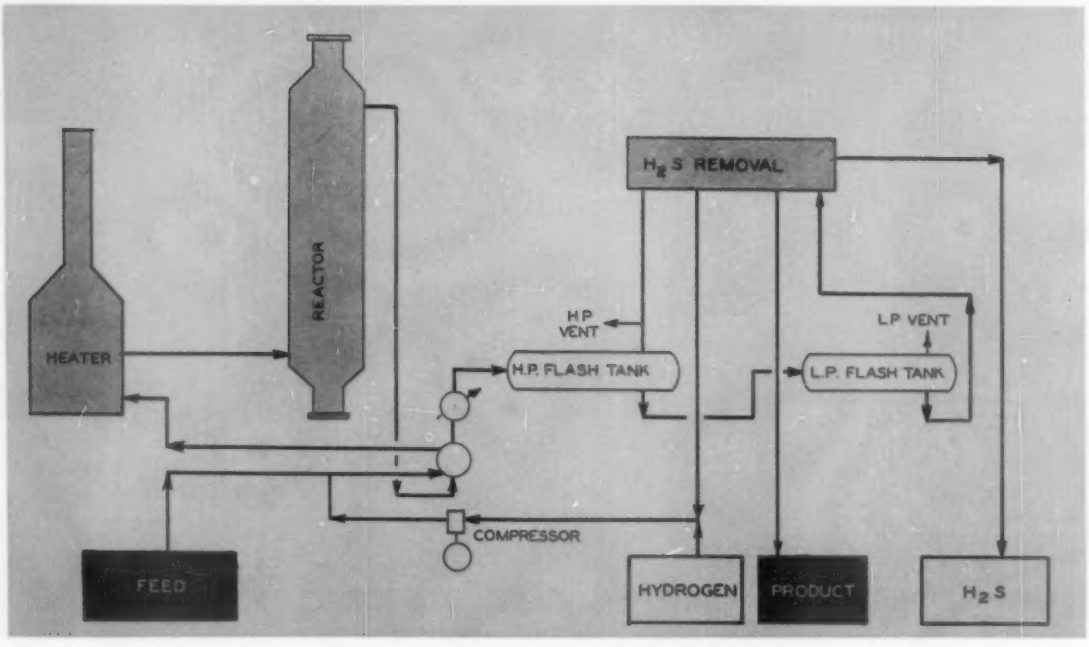
In other specific applications the stabilizer may be replaced by a stripper, rectified absorber, or other comparable equipment. The stabilized product is then ready for fractionation as indicated in the diagram, or may be utilized directly.

Products and yields . . . A 15,750-bbl. per stream day Unifining unit has been in full commercial operation for about 3 years treating a mixture of high-sulfur, high-nitrogen naphthas derived mainly from coking operations. The bulk of the product is reformer feed stock. Typical commercial data are:

UNIFINING COKER DISTILLATES

	Total charge (mixed Calif. distillates)	Products	
		Rerun overhead	Rerun bottoms
Gravity, °A.P.I.	47.8	55.0	38.6
I.b.p.	190	152	390
10 per cent	230	212	390
50 per cent	300	270	415
90 per cent	400	340	432
Maximum	450	380	490
Sulfur, total weight per cent	1.90	0.005	0.01
Nitrogen, basic, p.p.m.	225	0.2	1.0
Bromine No.	20	Nil	Nil
Doctor test	Sour	Sweet	Sweet
Liquid yield, volume per cent of charge		101	

Commercial installations . . . The first commercial installation was made in 1953. At the present time over 60 units have been licensed for operation. These units represent the application of Unifining to straightrun, thermal, catalytic and coker naphthas; straightrun kerosine and jet fuels, diesels, and burner oils; vacuum and visbreaker distillates and gas oils; catalytic cycle stocks; aromatic distillates; and lube oils. A Unifining license may be obtained from either Universal Oil Products Co. or Union Oil Co. of California, Commercial Development Division.



Vapor-Phase Hydrodesulfurization

SHELL OIL CO. has operated two selective vapor-phase hydrodesulfurization plants for nearly 10 years. The process employs a tungsten-nickel-sulfide catalyst at pressures from 500 to 750 psig.

Temperatures vary from 450° to 700° F. depending upon the feed and the condition of the catalyst. The operation is carried out in the vapor phase with low hydrogen-to-oil ratios.

The unit consists basically of an adiabatic reactor, a preheater, heat-exchange equipment, flash tanks for separating gas and products, compressors for recycling hydrogen, and treaters for removing hydrogen sulfide from both the recycle gas and the liquid product.

Raw feed is first mixed with hydrogen and the combined stream is preheated by heat-exchange with reactor products and then in a furnace. From the furnace, the feed passes in vapor phase to the adiabatic reactor. Reactor product is heat-exchanged with cold fed and then cooled by heat-exchange with water.

Gas remaining after the cooling step is treated to remove hydrogen sulfide and then recirculated. Make-up hydrogen is added to the recycle hydrogen. Liquid product from the high-pressure separator is first flashed at a low pressure to partially remove dissolved gases and then treated to remove hydrogen sulfide. A final caustic and water wash removes last traces of H_2S.

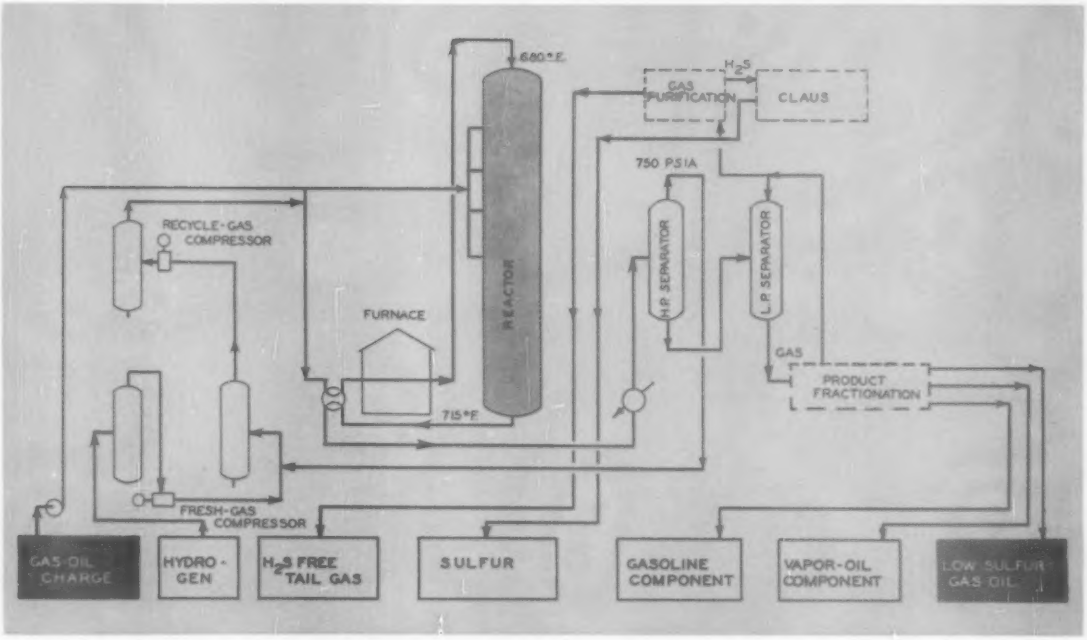
Table 1 shows feed and product properties before and after hydrodesulfurization of cracked naphthas.

A comparison of hydrodesulfurization costs with acid treating costs for a 9,300-bbl. per calendar day unit shows that the capital cost is $2,000,000 for hydrodesulfurization and $700,000 for acid treating. Total operating costs are $1,218 for hydrodesulfurization and $1,571 for acid treating. The 9,393 bbl. per day of product from hydrodesulfurization has a value of $57,861. The 8,713 bbl. per day of naphtha and 392 bbl. per day of cutter from acid-treating unit have a product value of $56,035. This leaves a net advantage for hydrodesulfurization of $2,179 per calendar day. Payout on total investment is 2½ years, while payout on incremental investment is 1.6 years.

Materials of construction for this type of plant should be adequate to resist the effects of hydrogen and hydrogen sulfide. Chromium and molybdenum in low concentrations are effective in preventing hydrogen damage at the pressures and temperatures used.

TABLE 1—FEED AND PRODUCT PROPERTIES, SELECTIVE HYDRODESULFURIZATION OF CRACKED NAPHTHAS

Operation—	Aviation base stock		Motor fuel	
Feed	Catalytically cracked naphtha		Catalytically cracked naphtha	
Crude source	L. A. Basin		L. A. Basin	
Operation:				
Hydrogen consumed, s.c.f. per bbl.	500		110-175	
Length of process period before regeneration required, months	3-4		2-3	
	Feed	Prod.	Feed	Prod.
Yield and properties of feed and products:				
Liquid yields, vol. per cent	100	102	100	101
Total sulfur, vol. per cent	0.28	0.003	0.50	0.20
Mercaptan sulfur, wt. per cent	...	...	0.002	0.003
Bromine No., g. per 100 g.	72	9	45	33
MAV, mg. per g.	30	0.1	20	1.2
Aromatics, wt. per cent	33	33	41	41
A.S.T.M. gum, mg. per 100 ml.	...	1	3	1
Copper-dish gum, mg. per 100 ml.	...	2	560	27
Induction period, hours	...	...	...	24+



Trickle Hydrodesulfurization

THE Shell trickle hydrodesulfurization process is designed to remove sulfur from petroleum fractions by catalytic means, using an outside source of hydrogen. Unique features of the process are its use of low hydrogen recycle rates and treatment of the oil largely in the liquid phase.

Liquid charge, together with hydrogen, trickles downward through a fixed bed of cobalt-molybdenum-alumina catalyst. Through this feature, it has come to be commonly known as the "trickle process." As in other hydrodesulfurization processes, sulfur removal is achieved by replacement of sulfur by hydrogen, with simultaneous formation of hydrogen sulfide.

Hydrogen-rich gas from caltalytic reforming operations can be readily used in this process, since normal dilution by hydrogen sulfide or methane do not affect the efficiency of the process significantly. Accordingly, no hydrogen sulfide removal is necessary on the recycle stream. Hydrogen consumption will range from 50 cu. ft. per pound of sulfur removed for straightrun stocks, to 75 for catalytic cycle stocks.

Basis for process . . . In developing the new technique, it was noted that desulfurization was most complete at hydrogen recycle rates corresponding to the break point between trickle and vapor-phase operation. Further, it was found that the reduction in sulfur removal was very small when hydrogen recycle rates were reduced from the range of 5,000 to 10,000 std. cu. ft. per bbl., corresponding to vapor-phase operation, to the range of 250 to 1,500 std. cu. ft. per bbl. in trickle operation.

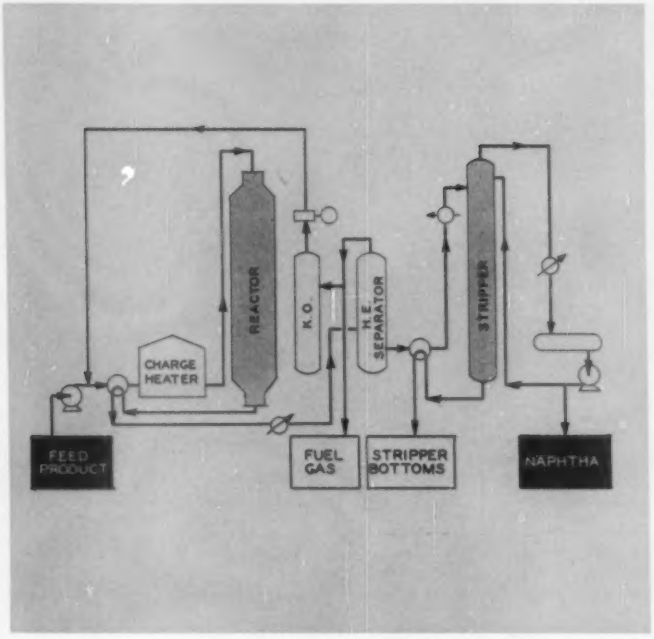
The commercial advantage of the trickle operation lies in the substantial savings in capital (compressor, furnace, exchangers, etc.) and operating costs. Trickle operation also permits the treating of higher-boiling fractions since they need not be vaporized.

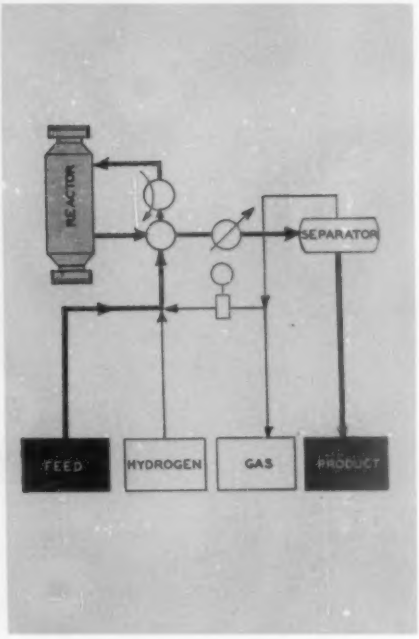
Process flow . . . The process flow is illustrated schematically. Oil charge together with fresh and recycle hydrogen is preheated by exchange with reactor effluent and further heated in a furnace before being charged to the reactor. The reactor may contain a number of catalyst beds, between which fresh charge can be injected to take up the heat of the hydrogenation reactions. The number of beds is determined by the sulfur content of the charge and the degree of desulfurization desired.

Reactor effluent is cooled and passes to the high-pressure separator where unreacted hydrogen is separated for recycle. In the low-pressure separation, the hydrogen sulfide and some of the light hydrocarbons are flashed off for delivery to the plant fuel system or to gas purification and sulfur-recovery facilities.

Depending on feed stock, the process is operated at pressures ranging from 300 to 1,000 psig., and at temperatures of 650° to 750° F.

Other uses . . . Although developed primarily for sulfur reduction, Shell hydrodesulfurization also upgrades straightrun distillates to yield high-grade diesel fuels, lube stocks, and burning oils. It improves flashed distillates as catalytic cracking feed stocks, resulting in lower coke production and higher gasoline yield; the attending reduction of nitrogen compounds also permits a higher cracking catalyst activity.





Diesulforming

PRIMARY purpose of Diesulforming is to reduce the sulfur content of the reforming charge stock. However, the process also removes nitrogen and oxygen and provides additional advantages of color, odor, and cetane improvement.

The diagram shows the Diesulformer to be simple in design. These units are usually closely integrated with a catalytic reformer or other source of the hydrogen for the treating reactions.

In this case the distillate feed stock and hydrogen recycle are first preheated by exchange with hot reactor effluent, then heated in a fired heater to the required reactor inlet temperature.

The charge passes down through a fixed-bed catalyst chamber where the desired reactions take place. After exchange with the charge, the reactor effluent is cooled before passing through the high-pressure separator where the liquid product is separated from the recycle gas.

The liquid effluent from the flash drum is stripped of hydrogen sulfide and any low-flash constituents. The bottom product from the stripper is a sweet desulfurized distillate that is ready for the market.

Catalyst . . . Catalyst activity has been remarkably good. Repeated regenerations are possible.

Temperature and space velocity are the important variables. Diesulfurization is directly proportional to the temperature and inversely proportional to the space velocity.

The first commercial installation was made in the United States in 1953. The first Canadian unit went on stream in 1956. A license to use the Diesulforming may be procured from Husky Oil Co., Cody, Wyo.

Selective Diolefin Hydrogenation

THIS process selectively hydrogenates diolefins to mono-olefins. It can be applied to alkylation feed stocks in which the presence of diolefins reduces acid life. In such an application, not only is acid life improved through removal of the objectionable diolefins, but an equivalent amount of desirable olefins is simultaneously produced. Selective hydrogenation of other stocks with diolefin contents of up to 25 per cent can also be achieved by this process.

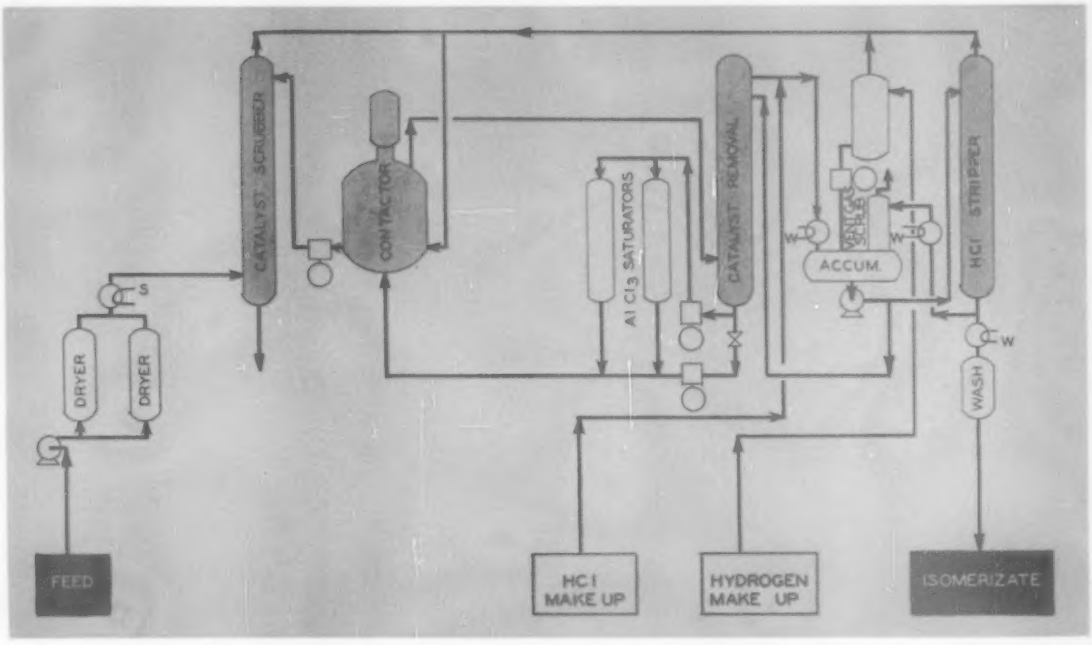
The scheme for carrying out the process is illustrated in the diagram. Feed and hydrogen are preheated by exchange with reactor effluent and vaporized before entering the reactor. The reactor product is cooled and phase-separated. Residual hydrogen is recycled or vented, and liquid product is sent to storage.

The catalyst used is nickel sulfide on alumina. A life of over 1,000 hours between regenerations has been obtained. Regeneration consists of burning off a surface deposit with diluted air followed by sulfiding with hydrogen sulfide.

The operating conditions are:

Temperature, °F.	300 to 700
Pressure, psig.	15 to 150
Mole ratio H_2/diolefin	1 to 12
Space velocity, vol./hr./vol.	1 to 10

This process has been used commercially at a throughput rate of 400 bbl. per day of C_4 charge containing 20 to 25 per cent butadiene. Shell Development Co., New York, N. Y., is the licensor.



Liquid-Phase Isomerization

IN THE SHELL liquid-phase isomerization process, which is entirely continuous and nonregenerative, normal butane or normal pentane is contacted in the liquid state with a catalyst consisting of aluminum chloride dissolved in molten antimony trichloride.

Charging stock . . . Either butane or pentane may be converted to the corresponding isoparaffin in the same plant. The only additional equipment required for converting the C_5 hydrocarbon are the hydrogen compressor and its surge. The compressor can be eliminated, however, if a source of hydrogen at the desired pressure is available so that it can be used on a once-through basis.

The feed hydrocarbon is mixed with dry hydrogen chloride gas which acts as a catalyst promoter. In addition, when pentane is isomerized by this process, it is necessary to introduce a disproportionate suppressor such as hydrogen along with the HCl, as disproportionation reactions, if not controlled, would result in a low ultimate yield of isopentane and high catalyst consumption.

In operation, the normal paraffin is charged continuously, at approximately atmospheric temperature, to one of two driers. Temperature of the dried feed is raised to about 180° F., before entering a packed catalyst scrubber column. Here a small side stream of catalyst from the contactor is countercurrently extracted with the feed.

The valuable active catalyst components are returned to the contactor in solution. The essentially inactive $AlCl_3$-hydrocarbon complex, formed as a result of side reactions, settles to the bottom of the column and is periodically drawn off.

Equipment . . . The feed stream, containing recovered aluminum chloride and antimony trichloride, flows from the top of the catalyst scrubber column and is joined with recycle hydrogen chloride and, in the case of pentane isomerization, recycle hydrogen prior to entrance into the reaction vessel.

The contactor is a vertical autoclave fitted with a mixture device to effect intimate contact of catalyst and hydrocarbon. Period of contact is relatively short, the charge remaining 10 to 15 minutes in the contactor. A high average conversion is obtained; 45 per cent or better for butane and 55 per cent or better for pentane. Separation of the isomerate from the catalyst takes place in the baffled upper section of the contactor.

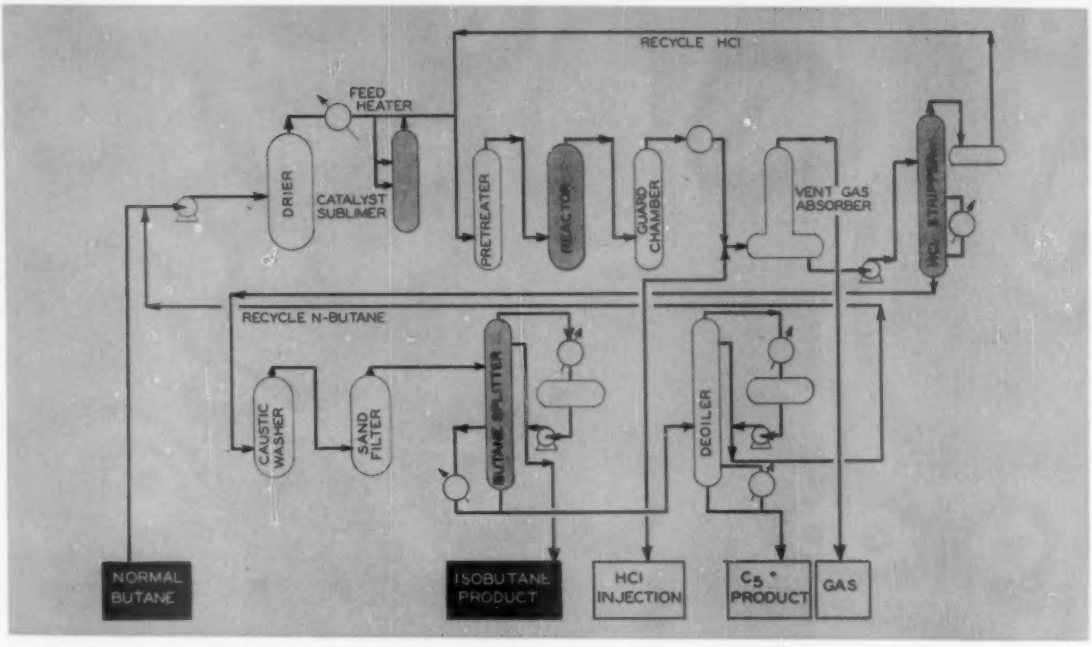
From the contactor the converted hydrocarbon stream flows to the catalyst column for separation and recycle of the dissolved catalyst components.

The small amount of noncondensate gas formed in the process is vented from the vapor space of the accumulator through a packed absorber. The HCl content of the vent gas is reduced to a minimum by a countercurrent wash with a cooled sidestream taken from the bottom product of the HCl stripper.

In pentane isomerization, most of the hydrogen is recycled from the vapor space in the accumulator; however, some remains in solution and passes to the HCl stripper from which it is recycled with the HCl.

From the catalyst column accumulator the isomerizate is pumped to the HCl stripper. The acid gas is removed from the top of the stripper and recycled to the contactor. The bottoms product stream is cooled and washed with dilute caustic to remove final traces of hydrogen chloride and antimony trichloride, and the neutralized isomerizate then passes to storage or subsequent operations.

Licensor for this process is Shell Development Co.



N-Butane Catalytic Isomerization

THIS is a vapor-phase catalytic process for producing high-purity isobutane from normal butane. The catalyst utilized is aluminum chloride promoted with HCl.

A dry normal butane feed stock is vaporized, superheated, and fed, along with recycle HCl vapors, to a pretreater. The pretreated feed passes to the reactor. Both pretreater and reactor are bed-type chambers containing aluminum chloride sublimed on bauxite. The HCl vapors serve as a catalyst promoter. The reactor effluent of isobutane, normal butane and trace side reaction products pass through a bauxite filled guard chamber and are condensed in a series of effluent exchangers.

Noncondensables Removed

Trace noncondensables are removed from the liquid effluent stream in a vent-gas absorber and HCl is removed by stripping. HCl vapor overhead from the stripper is recycled to the feed pretreater. The stripper bottom product is caustic-washed and sand-filtered before being charged to the fractionation section consisting of a deisobutanizer and a deoiler tower. High-purity isobutane is yielded as an overhead product from the deisobutanizer. Normal butane is yielded overhead from the deoiler and recycled to the unit driers. A small quantity of pentane plus production is yielded as a bottom product of the deoiler.

Catalyst is added to the system by subliming the aluminum chloride with hot feed and depositing it on the bauxite in the pretreater and reactor. Makeup HCl is injected into the system downstream of the effluent exchangers.

Information about the butane isomerization process may be obtained from the Perco Division, Phillips Petroleum Co.

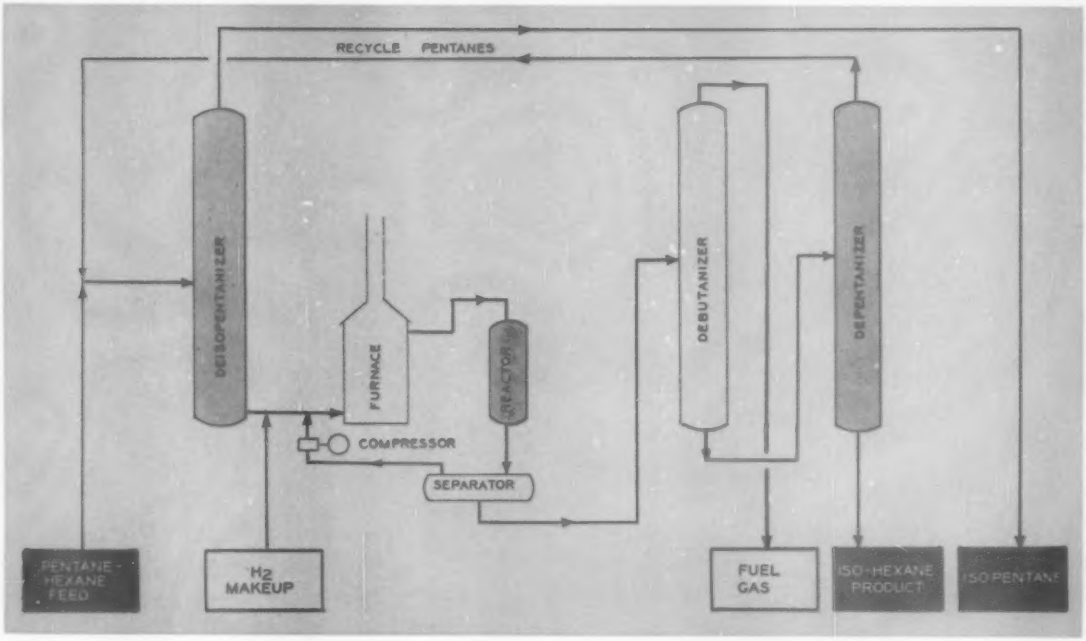
TYPICAL CHARGE AND YIELD

Basis—100 bbl. of charge—50 per cent conversion per pass

	Charge (bbl.)	Isobutane yield (bbl.)	Deoiler bottoms (bbl.)	Vent gas (s.c.f.)
Ethane and lighter				Trace
Propane		5		
Isobutane	2	85		
Normal butane	96	2		
Pentane plus	2		8	
	100	92	8	

	Unit/bbl. isobutane produced
Utilities:	
Water circulation, 1,000 gal.	1.5
Water makeup, 1,000 gal.	0.045
Power, kw.-hr.	1.54
Steam, 1,000 lb.	0.680

	Lb./1,000 bbl. iC_4 produced
Chemicals:	
Aluminum chloride	85
HCl	70
Bauxite	440
Driocel for driers	7
Caustic	89



Kellogg Isomerization (Iso-Kel)

ISO-KEL is an M. W. Kellogg Co. process for isomerizing light naphthas designed to help increase the high-octane pool. The vapor-phase process can upgrade combined streams of pentane and hexane fractions as well as natural gasoline. Yields of 98 per cent and higher can be obtained depending on the charge.

The use of a new, precious-metal catalyst (nonplatinum) makes it possible to increase the octane quality of straightrun naphthas and natural gasolines by isomerization of pentanes and hexanes simultaneously in one process unit with no harmful interaction.

Two products . . . One desirable application of Iso-Kel produces two separate products: (1) an isopentane stream of 104.0 C.F.R.R. + 3 cc. TEL, and (2) an isohexane stream of 89 to 93.5 C.F.R.R. + 3 cc. TEL, depending on the feed stock. The isopentane stream can be allocated to the superpremium gasoline; the isohexane stream to the housebrand.

When charging light naphtha, the combined streams have an over-all yield of 98 volume per cent and an octane number of about 96 C.F.R.R. + 3 cc. TEL. When feeding natural gasoline, over-all yield is 99 volume per cent and octane number about 99.6 C.F.R.R. + 3 cc. TEL.

Depending upon feed-stock quality and degree of upgrading desired, the process scheme will be varied to allow for prefractionation of isomers in the feed, and recycle of unconverted material. In general it is preferable to process pentanes on a recycle basis, and to process hexanes once through.

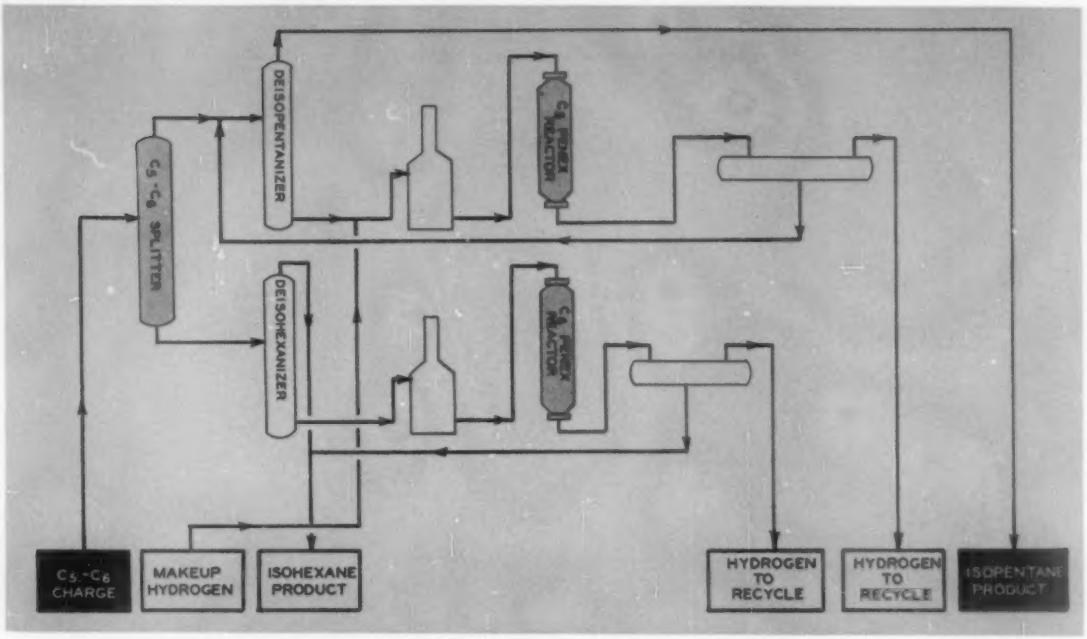
Operating results are shown in Table 1, while Table 2 shows the economics of the operation. Case 1 of Table 2 is for recycle isomerization of n-pentane cut containing 7 volume per cent hexanes. Case 2 is for isomerization of mixed pentane-hexane, recycle operation on pentane. Case 3 is same as Case 2, but including deisohexanizer. Case 4 is same as Case 1, but with increased throughput.

TABLE 1—ISOMERIZATION OF PENTANE HEXANE FRACTION FROM COMMERCIAL STOCKS

	Kuwait		Mid-Cont.		Nat. gaso.	
Total C_5-C_6:	Feed	Product	Feed	Product	Feed	Product
Vol. per cent	100.0	98.6	100.0	98.3	100.0	99.2
Oct. No. C.F.R.R.						
Clear	64.1	79.0	63.0	78.0	73.0	85.7
+ 3 cc. TEL	88.2	96.0	86.5	95.0	93.4	99.6
Isopentane fraction:						
Vol. per cent of total	45.0	45.0	34.5	34.5	58.5	58.5
Oct. No. C.F.R.R.						
Clear	74.4	92.0	72.9	92.0	79.2	92.0
+ 3 cc. TEL	95.8	104.0	94.5	104.0	98.0	104.0
Isohexane fraction:						
Vol. per cent of of total	55.0	53.6	65.5	63.8	41.5	40.7
Oct. No. C.F.R.R.						
Clear	55.9	68.0	57.7	70.5	64.0	76.4
+ 3 cc. TEL	82.0	89.0	82.3	90.0	86.8	93.5

TABLE 2—ECONOMICS OF ISOMERIZATION OF KUWAIT PENTANES AND HEXANES

Case—	1	2	3	4
Product Octane No.				
C.F.R.R.—Clear	90.9	79.0	79.8	90.9
+ 3 cc. TEL	102.2	96.0	96.7	102.2
Capacity, bbl./day	1,495	3,100		3,500
Process investment	$825,000	1,100,000	1,425,000	1,475,000
Direct operating cost, cents/bbl.	24	16	22	21
Payout, years	1.4	1.4	1.8	1.0
Cost, cents/RONB	10.6	7.6	8.4	9.6



U.O.P. Penex

PENEX is a recently announced U.O.P. process for isomerizing the butane through octane hydrocarbons from refinery naphthas and natural gasolines, using a platinum-containing catalyst in the presence of hydrogen. Maximum yields are obtained by separately processing close-cut fractions, rather than mixtures. In small-capacity installations, however, it may be found more desirable to isomerize the mixtures because of the smaller capital investment involved with simpler facilities.

The flow scheme indicated assumes a mixed C_5-C_6 charge and individual isomerization of pentanes and hexanes. It is split into two cuts, each of which is further split to remove the lower-boiling high-octane isomers from the respective reactor charges. The selected fraction is mixed with hydrogen, heated, and admitted to the appropriate reactor.

Over-all heat of reaction is low and operating conditions are mild in severity. Hydrogen is not consumed in significant quantities and generally is recycled; the makeup supply normally is derived from the net hydrogen-rich gas production of the U.O.P. Platforming unit.

Types of operation . . . Penex processing may be either once-through or employ recycling of unconverted hydrocarbons in any degree of flexibility desired for the individual installation. Both features are illustrated in the flow diagram.

Catalyst regeneration is not employed. This feature not only reduces the original capital investment but greatly simplifies the operation while minimizing maintenance requirements. Corrosion-resistance construction is not required, as the catalyst and product are noncorrosive and the absence of regeneration precludes cyclical swings in temperatures and composition of the atmospheres in contact with the reactor section.

Several commercial units are being designed or under construction but none are as yet operating. High yields are expected, on the basis of pilot-plant operations. Typical yields are shown in the table for pentane and hexane isomerization.

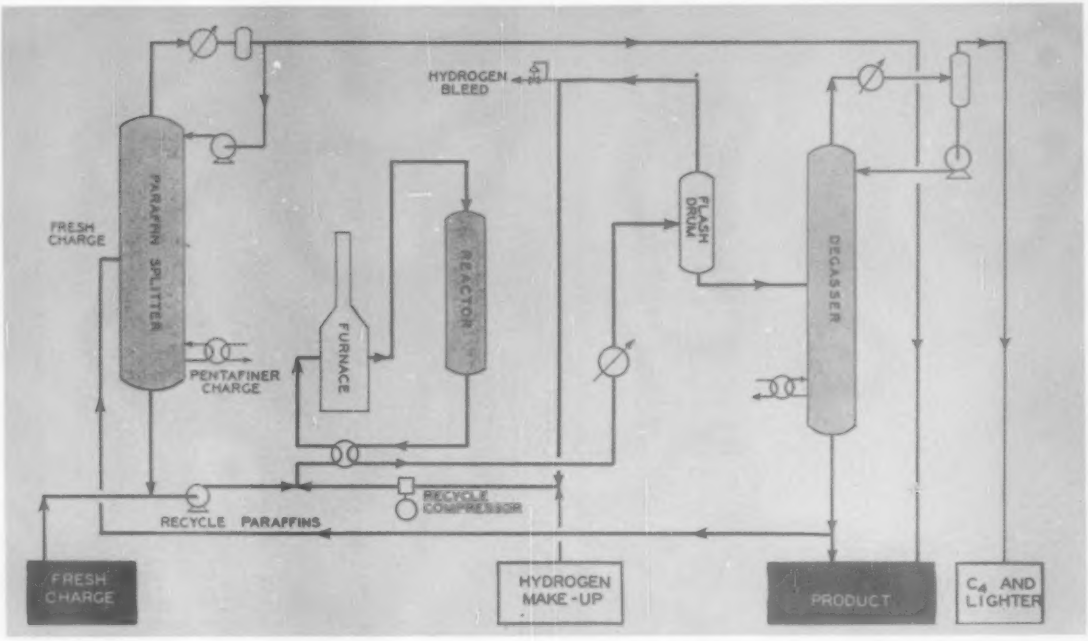
Limited space prevents the presentation of specific economic data due to the wide differences which may exist in building and operating individual units, since the possible process applications are so extremely varied. Qualitatively speaking, therefore, the Penex process is economically attractive because the high yields anticipated will provide a sizable increase in the leaded octane quality of the refinery pool gasoline.

The Penex process is licensed by Universal Oil Products Co.

YIELDS FROM PENTANE AND HEXANE ISOMERIZATION

	Pentane isomerization		Once-through hexane isomerization	
	Feed, mixed C_5's	Isopentane product	Feed, mixed C_6's	Isohexane product
Yields, vol. per cent of feed	100.0	*99.0	100.0	†97.0
Octane rating:				
F-1 clear	76.4	90.4	60.0	75.0
+3 ml. TEL	94.5	104.2	83.0	94.0
R.v.p., psi.	18.2	21.1	6.1	7.5

*Isopentane content, 95 volume per cent. †Mixture of hexane splitter overhead with reactor effluent.



Pentafining

PENTAFINING is a catalytic process developed by Atlantic Refining Co. for the isomerization of normal pentane and normal hexane. Good octane improvement is obtained with minor losses to hydrocarbons lighter or heavier than the charge.

This process may be applied economically to the C_5-C_6 fraction of straightrun naphtha, natural gasoline, and catalytic reformates. It is attractive for the production of high-octane blending stocks for both aviation and motor gasolines.

Process flow . . . The flow diagram illustrates operation on a mixture of C_5 or C_6 paraffins. If the normal paraffin content is high enough, the feed will be charged directly to the Pentafiner reaction section. In many cases, however, a splitter tower will be justified to concentrate the normal paraffins in the reactor charge. Economics again will dictate whether the Pentafiner product is recycled to the splitter for further octane improvement or is sent directly to gasoline blending.

Pentafining catalyst is a combination of platinum and silica-alumina specifically designed to promote isomerization with low losses to fuel gas. Use of silica-alumina gives the catalyst complete tolerance for water and nitrogen compounds and requires no halide promoters, which contribute to unit corrosion. The catalyst is readily regenerable with a simple air-in-steam mixture.

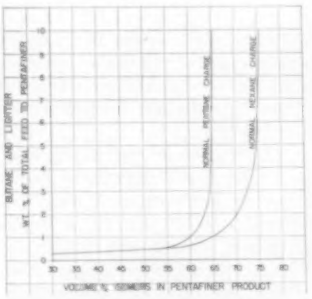
TABLE 1—YIELDS OF OCTANE IMPROVEMENT FROM C_6 ISOMERIZATION

	Middle East
C_6 charge:	
Research octane, clear	59.8
Research octane, 3 cc.	85.6
R.v.p.	5.4
C_6 product:	
Research octane, clear	73.3
Research octane, 3 cc.	93.3
R.v.p.	5.9
Volume per cent of charge	96.5

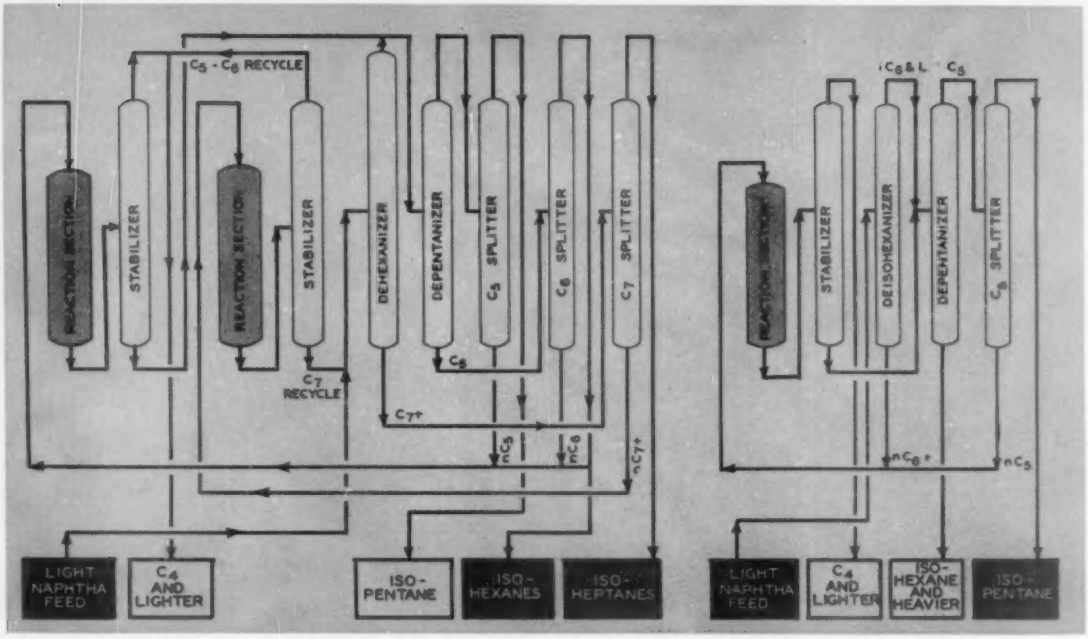
Process performance . . . Fig. 1 shows the selective nature of the catalyst at pressures of 300-700 psig. and temperatures of 750°-950° F. It is possible to operate at close to chemical equilibrium with insignificant losses to hydrocracking. Fig. 1 is based on a single pass through the reaction section. Ultimate conversions of close to 100 per cent are possible by recycling and fractionating out the isoparaffins produced.

The yield of 95 per cent isopentane from any mixture of pentanes charged will be 99-100 per cent on a volume basis. Octane improvement will be up to 29 research numbers clear or 20 at 3 cc. TEL. Yield and octane improvement from hexanes from typical Middle East crude are shown in Table 1.

Investment and operating costs . . . The low hydrogen recycle and catalyst requirements, and the basic simplicity of the Pentafiner, result in an investment of $100-$200 per barrel of charge, depending on size. Operating costs are in the range of 10-15 cents per barrel. Investment and operating costs for fractionation will depend upon the charge stock and the individual refinery situation.


BUTANE AND LIGHTER
WT. % OF TOTAL FEED TO PENTAFINER
NORMAL PENTANE CHARGE
NORMAL HEXANE CHARGE
VOLUME % ISOMERS IN PENTAFINER PRODUCT

SELECTIVE CATALYST is used in the Pentafining reactors. Fig. 1.



Isomerate Process (Pure Oil)

THE Isomerate process of the Pure Oil Co. upgrades low-octane hydrocarbon feed stocks in the presence of hydrogen and a catalyst containing neither noble metals nor corrosive materials. Normal pentane, normal hexane, and normal heptane are readily isomerized to high-octane branched-chain isomers at high yields.

An alternate processing method permits the conversion of the very-low-octane-number heptanes to high-octane-number isopentanes and isohexanes. Thus, feeds of near zero octane are upgraded to yield a product of about 100 octane with 3 ml. TEL. The only limitation is the refiner's ability to utilize the more volatile products advantageously.

Integration of the Isomerate process with catalytic reforming is attractive not only in reducing installation cost and operating expenses, but in obtaining a substantial improvement in the yield-octane relationship of catalytic reforming. The Isomerate process is particularly suitable for upgrading the low-octane-number paraffinic hydrocarbons remaining after extraction of aromatics from catalytic reformates.

Process flow . . . Numerous combinations of reactors and fractionators are possible for the isomerization and processing of light-hydrocarbon stocks. The various feed components can be processed jointly or singly and on a once-through or recycle basis.

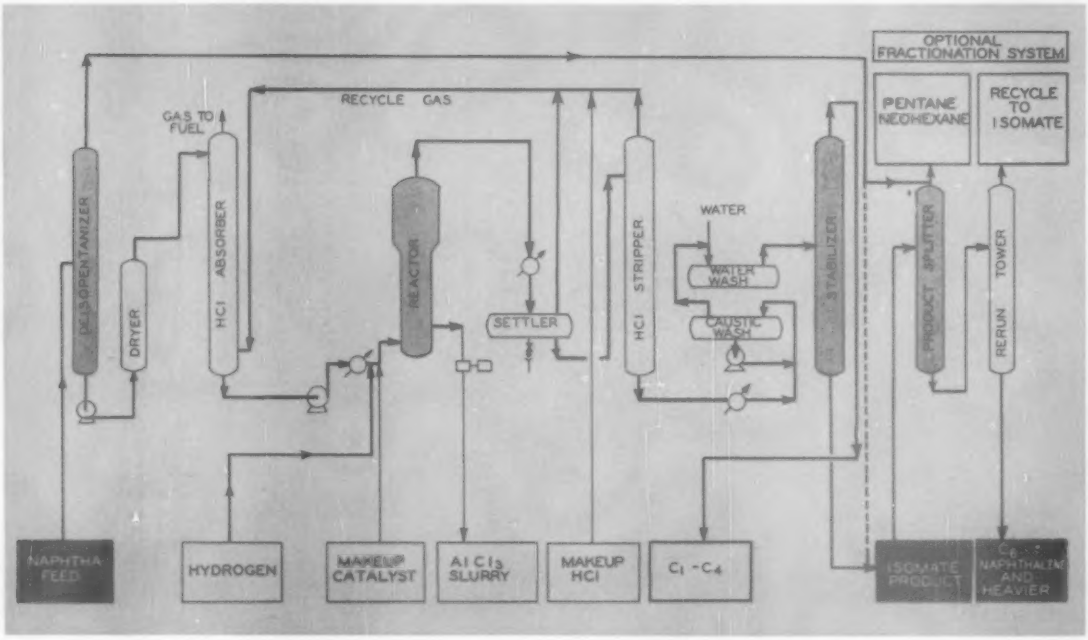
The flow diagrams illustrate two of the many possible processing schemes. In the first diagram the higher-boiling low-octane heptanes are converted and the reactor effluent is fractionated to recycle the low-octane heptanes. The high-octane isoheptanes (including naphthenes) are removed as product. The hexanes and lighter portions of the fresh feed and recycle streams are fractionated to produce high-octane isopentane and isohextane products. The lower-octane n-pentane and n-hexane cuts are recycled to the isomerization reactor for complete conversion.

The second flow diagram illustrates one of the simpler, less-costly processing schemes. The fresh feed is fractionated to supply a normal hexane and heavier reactor feed for once-through processing. The n-pentane from the fresh feed and the reactor effluent is recycled to effect complete isomerization. The two product streams contain both the synthetic and the naturally occurring isoparaffins. One stream contains only isopentane while the other is composed of branched-chain hexanes and heptanes.

Feed stocks . . . Any of the conventional refinery light hydrocarbon stocks are potential Isomerate feeds. Suitable feeds include: Normal pentane, normal pentane and n-hexane, light straightrun naphthas and gasolines, natural gasolines, light catalytic reformate, light catalytic reformate raffinates, and hydrotreated light thermal, coker, or visbreaker naphthas.

Operating conditions . . . The mild operating conditions of the Isomerate process insure high yields at conversion levels approaching equilibrium. Reactor pressures are below 750 psi. and temperatures are below 750° F. A rugged isomerization catalyst is employed which can be regenerated in place at infrequent intervals.

Product quality . . . The research octane number of the isopentane product approaches 108.6 (with 3 ml. TEL), depending, of course, upon the degree of fractionation. Most straightrun naphthas (200° F. e.p.) produce an Isomerate having an F-1 octane of 94 to 100 plus at the 3-ml.-TEL level, depending upon feed composition, extent of recycling, and efficiency of fractionation.



Isomate Process

THE Isomate process of Standard Oil Co. (Indiana) isomerizes low-octane pentanes and hexanes to high-octane branched isomers. The process complements catalytic reforming by upgrading light naphthas which are difficult to reform. The Isomate process was first used commercially during World War II to produce aviation-gasoline blending stocks.

Through the use of new materials of construction and improvements in the process, the Isomate process has been adapted to the present-day needs of refiners for high-octane motor-gasoline blending stocks. In addition to raising octane, Isomate product improves road performance of fuels.

The process charges mixed pentane-hexane feeds, or, if desired, hexanes only.

Product . . . The octane number of Isomate product depends on whether once-through or recycle operation is employed. Leaded, research octane numbers ranging from 95 to 106 (G.M. extension scale) are obtained. The product is an excellent blending stock because of its high octane and because research octane numbers correspond closely with motor and road ratings.

The process may be designed for once-through operation (shown to the left of the vertical broken line) or recycle may be added if even higher octane-number products are required. The catalyst is an aluminum chloride-hydrocarbon complex promoted with anhydrous hydrogen chloride. Hydrogen gas is supplied to the reaction zone to suppress cracking and disproportionation and to maintain catalyst activity.

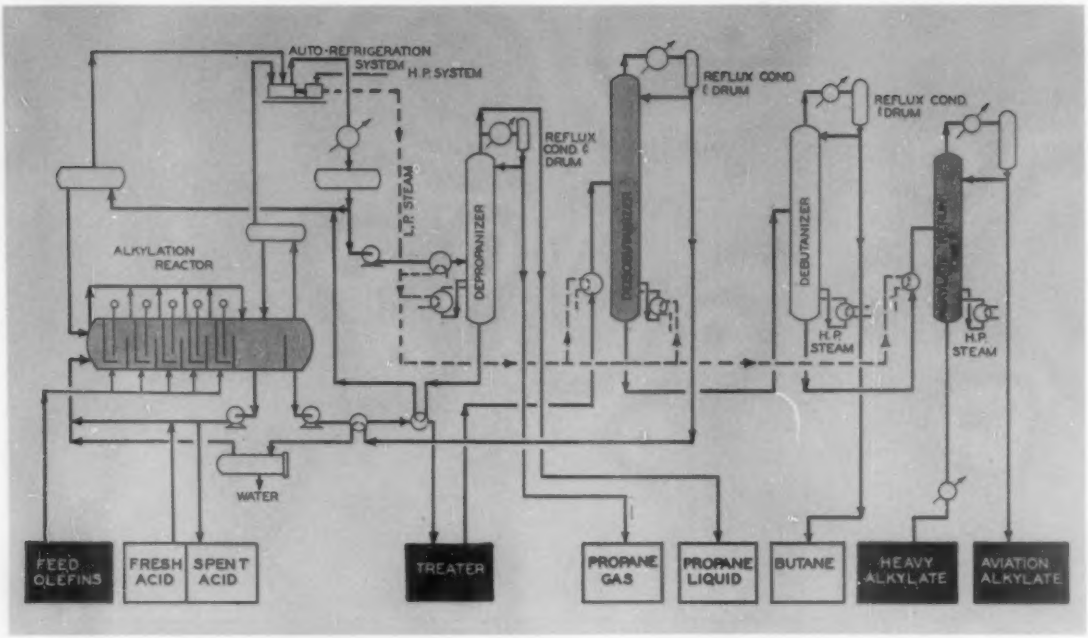
If product having a leaded octane number above about 97 is desired, the stabilized Isomate product is fractionated to separate high-octane neohexane, diisopropyl, and isomerized pentanes as overhead; the low-octane bottoms are rerun and recycled for further isomerization.

Operating conditions . . . The Isomate process employs reaction temperatures of about 240°-250° F. Hydrogen is added to obtain a total reaction pressure of about 700-800 psi. Once-through and recycle Isomate yields from mixed pentane-hexane feeds are shown in the accompanying table.

. . . Investment costs are about $400 per barrel capacity for a once-through process and $800 for a recycle plant. The operating costs, including utilities, chemicals, labor, and maintenance, range from about 25 to about 45 cents per barrel, depending on whether a once-through or recycle operation is employed.

TABLE 1—TYPICAL FEED AND PRODUCT INSPECTIONS

		C5+ products			
			Recycle		
A.S.T.M. dist., °F.:	Feed	Once through	Neohexane product	Naphthenic product	Combined product
I.b.p.	104	96	93	163	93
10 per cent	114	104	100	169	100
50 per cent	126	118	111	178	112
90 per cent	144	140	124	223	128
Max.	154	190	131	290	230
Gravity, °A.P.I.	82.6	84.5	86.8	59.4	85.7
R.v.p., psi.	10.1	12.1	13.4	3.7	13.1
Research octane No.:					
Clear	70	83	90	71	89.5
+ 3 cc. TEL	88	97	101.4	85	101
Yield, vol. per cent:					
C5+		97.3	92.7	3.0	95.7
Butanes		2.9	4.5		



Sulfuric Acid Alkylation (Kellogg)

SULFURIC acid alkylation is a low-temperature process which employs a concentrated sulfuric acid catalyst to combine olefins such as propylene, butylenes, or pentenes with isobutane.

The process has many advantages over catalytic polymerization because:

1. Isobutane as well as olefins are converted, resulting in an increased product yield.
2. Alkylate is essentially free of gum-forming materials so that additives are not required.
3. Alkylate has a higher tetraethyl lead response.
4. Performance in supercharged engines is superior to catalytic polymerization gasoline.

In Cascade alkylation units, developed and licensed by M. W. Kellogg Co., isobutane is reacted with olefins to form saturated isoparaffins in the presence of sulfuric acid catalyst. Propylene, butylene, and amylene olefins are converted either individually or in mixtures, and are combined with the isobutane in a highly agitated emulsion in which the continuous phase is sulfuric acid catalyst.

Acid consumption . . . Acid consumption accounts for the major operating cost in a sulfuric acid alkylation unit. There are, then a number of advantages which accrue if acid consumption can be reduced.

Commercial data show that acid consumption decreases in plants operating for high-quality alkylate product, and that acid consumption decreases as strength of charge acid increases.

Treating system . . . A new reactor effluent treating system, which is an improvement over caustic-water effluent treating shown on the flow sheet, is now in use. More than 98 per cent of the sulfur from the reactor effluent stream is removed by the new method. This compares with approximately 65 per cent removal by the caustic-water system.

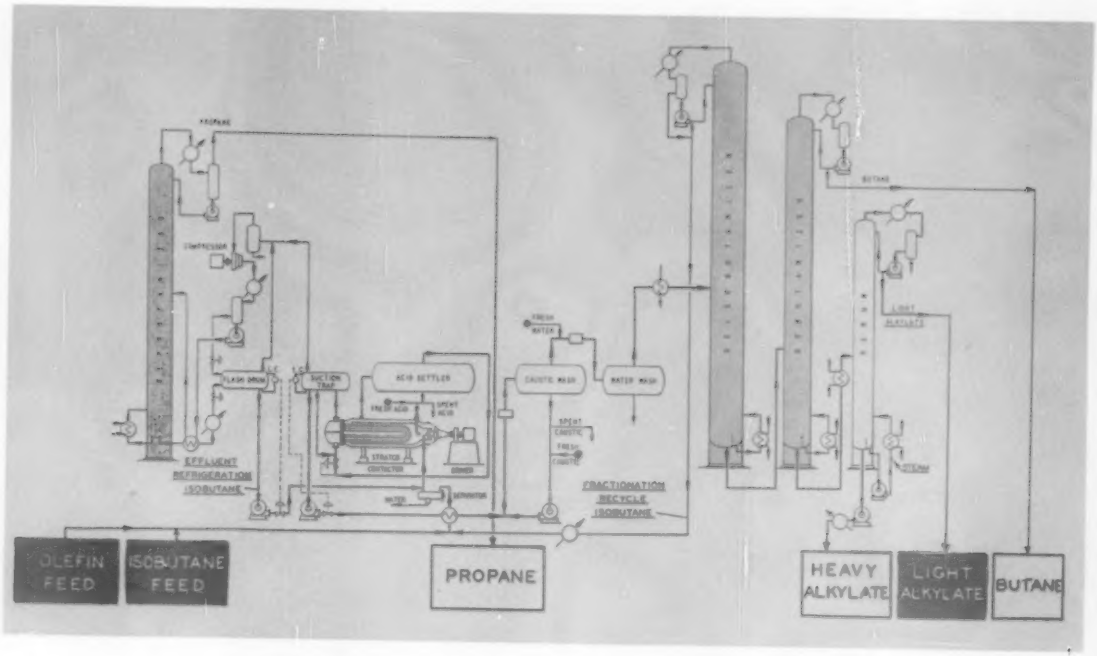
Advantages of the new system are (1) reduction in fractionator tower and reboiler fouling, (2) reduction in the use of inhibitors, and (3) substantial TEL savings.

Yield . . . Yield of alkylate from several typical feed streams are compared in Table 1. Higher acid consumption, lower aviation alkylate yields, and lower octane values are typical for operation where low isobutane-olefin ratios or low isobutane concentration are used in the reactor.

TABLE 1—TYPICAL ALKYLATION YIELD DATA

Olefin feed type—	Propylene	Propylene-† butylene‡	Butylene	Amylene
Yield (vol. per cent on olefins):*				
Total alkylate	178	174	172	160
Aviation alkylate (338° F. e.p.)	150-160	156-162	153-165	140-149
Isobutane consumption:				
Gal. iC_4 per gal. olefin	1.275	1.17	1.106	0.965
Acid consumption:				
Pounds 98 per cent H_2SO_4 per gal.	1.8-2.0	1.0-1.3	0.4-0.6	1.0
Aviation alkylate quality:				
Research Oct. No.:				
Clear	89-92	93-95	94-97	92-93
3.0 cc. TEL	101.6-103	103.5-104.9	104.2-106.2	103-103.7
A.S.T.M. Oct. No.:				
Clear	87-90	91-93	92-95	90-92

*True alkylate—corrected for components in feed. †40 per cent. ‡60 per cent.



Effluent Refrigeration Alkylation

BY using the effluent refrigeration process, alkylate can be made economically so that its use in motor fuel may be justified, and with the same plant and process the alkylate required for aviation gasoline of the highest quality may be made. Ten of these units are in operation, eight units are under construction, and others are under consideration.

Lower costs . . . Effluent refrigeration applied to the sulfuric acid alkylation process results in lower capital investment, decreased operating costs, increased yield, higher-quality alkylate, and lower acid consumption. Effluent refrigeration is essentially a means of economically obtaining a very high isobutane concentration in the reaction mixture with little conventional fractionation. The hydrocarbon portion of the reaction mixture or hydrocarbon effluent from the reactor after separation in the settler becomes the refrigerant used in the cooling elements of the reactor, and hence the term effluent refrigeration.

It is economical to operate with an isobutane to olefin ratio of 8 to 9, or an isobutane concentration as high as 75 per cent in the hydrocarbon portion of the reaction mixture, whereas the attainment of these figures by conventional fractionation cannot usually be justified from an economic standpoint.

Reactor system . . . The contactors used are of the new horizontal design using a U-tube heat exchanger. Very efficient heat transfer is obtained, resulting in close temperature control and a small cooling-surface requirement. Reactors of this design result in economies of installation and maintenance.

Catalyst consumption . . . The catalyst consumption depends upon a number of factors such as the composition of the feed stocks; amount of impurities in the feed stocks, such as water, butadiene, and sulfur compounds; and the operating conditions. However, under favorable operating conditions the consumption of sulfuric acid may be as low as ¼ lb. of acid per gallon of alkylate, and under most commercial conditions encountered the consumption for butylene alkylation is in the range of 0.4 to 0.5 lb. per gallon.

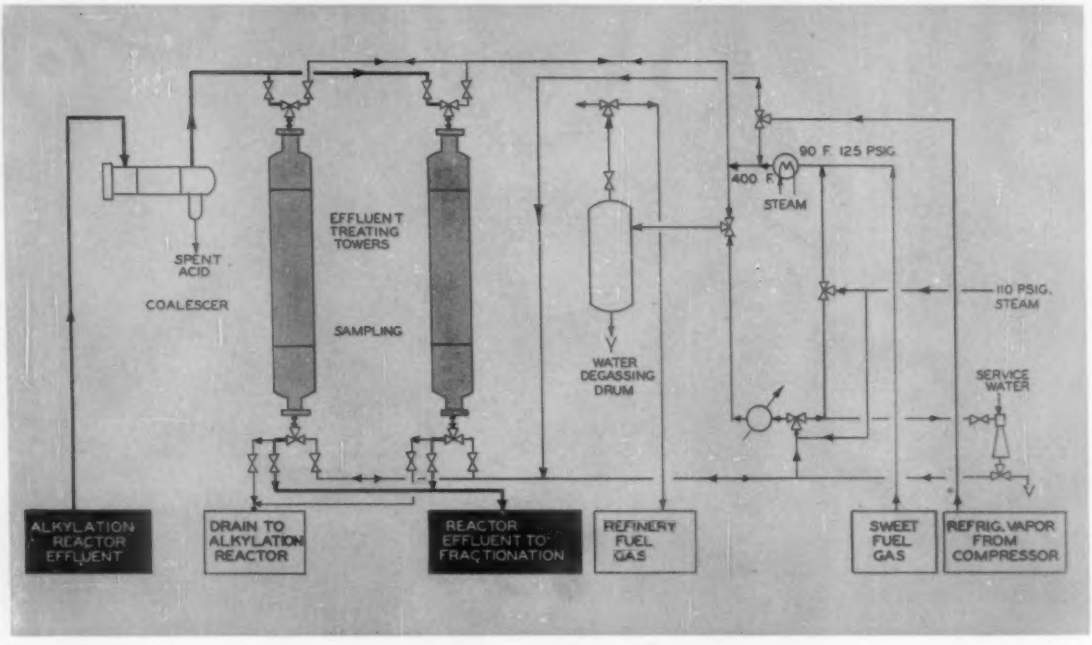
Note in Table 1 the high quality of the alkylates. For either butylene alkylates or mixed propylene-butylene alkylates the end point of the total alkylate should be in the range of 380° to 400° F., so that if desired, the entire alkylate may be used in motor fuel.

Information about the effluent refrigeration alkylation process may be obtained from Stratford Engineering Co., Kansas City, Mo.

TABLE 1—TYPICAL YIELD AND QUALITY DATA

	Butylenes	Mixed propylene-butylenes*
Debutanized total alkylate:		
E.p., °F.	375-400	375-400
C.F.R.R. (F-1) clear	94-96	93-95
C.F.R.R. 3 cc. TEL	From S+0.4 to S+1.0 cc. TEL	From 100 to S+0.5 cc. TEL
Aviation alkylate:		
Per cent of total alkylate	96-98	94-97
E.p., °F.	338	338
C.F.R.R. (F-1) clear	95-97	92-95
C.F.R.R. 3 cc. TEL	From 100 to S+1.2 cc. TEL	From 100 to S+0.8 cc. TEL
1C Performance No. 4.6 cc. TEL	120-130	115-122
3C Performance No. 4.6 cc. TEL (Supercharged) F-4	152-165	146-152

*Approximately 40 per cent propylene—60 per cent butylenes.



Alkylation—Effluent Treating

REMOVAL of 99 per cent of acid and both acidic and neutral esters from alkylation reactor effluent is now possible. The new treating process, developed jointly by D-X Sunray Oil Co. and M. W. Kellogg Co., employs bauxite to adsorb the troublesome byproducts of sulfuric acid alkylation.

The first unit has successfully reduced corrosion and fouling in alkylate fractionating equipment and has improved lead susceptibility in motor alkylate by effective sulfur removal. The 98 to 99 per cent efficiency of this process compares with 65 per cent removal of sulfur obtained in the conventional caustic wash system.

The new treating process is used in conjunction with a coalescer which provides the equivalent of added settling time in the alkylation unit. This horizontal vessel, packed with glass wool and steel mesh, performs an initial separation of suspended drops of acid and sulfur hydrocarbons.

The total effluent from the alkylation reactor is then charged alternately to the top of two treating towers. As it percolates downward through medium mesh bauxite, acid and esters are preferentially adsorbed.

Sample tests indicate when the stream should be switched to the regenerated bauxite in the alternate tower. Samples are taken at a point above the bottom of the bed to provide advance warning of adsorbent saturation.

Cycle life is about ¾ bbl. of effluent throughput per pound of bauxite. A charge of bauxite in this unit has been in use for an extended period of time and cumulative life is in excess of 150 bbl. per pound.

The treating process provides the only sure protection against these maintenance troubles. Table 1 summarizes the comparable efficiencies of bauxite treating and caustic wash systems.

Capital costs of the new treater are comparable to conventional caustic facilities. The economic evaluation of the two systems is shown in Table 2.

The alkylation effluent treating process is licensed by M. W. Kellogg Co. Design data are available in five standard sizes ranging from 5,000 to 25,000 bbl. per stream day of reactor effluent.

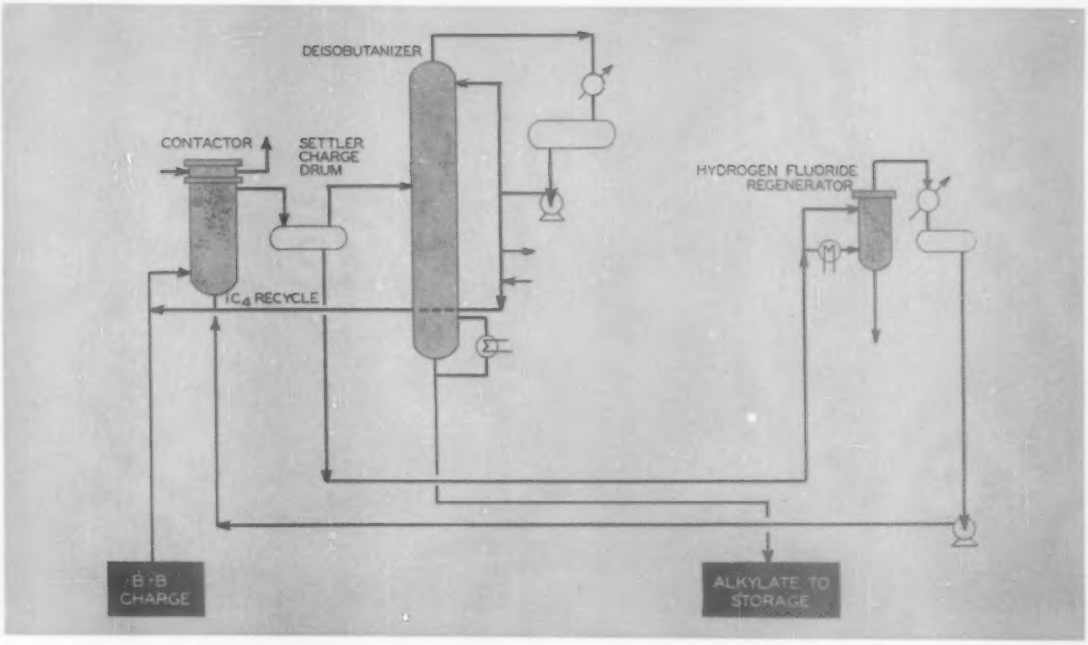
TABLE 1—COMPARISON OF EFFICIENCIES

	—Coalescer and caustic—	
	Weight per cent sulfur	Per cent removal
Reactor effluent	0.127	0
Coalescer effluent	0.025	80
Coalescer wash system	0.009	92.8
Bauxite treating unit	0.00037	99.71

TABLE 2—ECONOMIC EVALUATION OF BAUXITE TREATING INSTEAD OF CAUSTIC AND WATER WASHING

(Basis: 14,000 bbl. per stream day reactor effluent)

Item—	Quantity	Unit price	$/D
Credits:			
Caustic	450 lb./day	$0.05 lb.	22
Inhibitor (T.E.A.)	47 lb./day	0.24 lb.	11
Process water	147,000 gal./day	$0.09/1,000 gal.	14
Acid cons. savings	1,480 lb./day	15 ton	11
TEL savings	0.15 cc./gal.	0.0023 cc.	73
Total			131
Debits:			
Process water	19,700 gal./day	$0.09/1,000 gal.	2
Cooling water	84,000 gal./day	0.009/1,000 gal.	1
Steam	22,000 lb./day	0.30/1,000 lb.	7
Bauxite	140 lb./day	0.05 lb.	7
Total			17



HF Alkylation (U.O.P.)

THE HF alkylation process is a catalytic method of reacting isobutane with propylene, butylenes, amylenes, higher-boiling olefins or mixtures of olefins from thermal or catalytic cracking, to form a highly branched paraffinic product of excellent antiknock properties and tetraethyl lead susceptibility for use as a blending component in aviation gasoline or motor fuel. Butylenes, or butylenes-plus-propylene are the most common olefin charging stocks.

Hydrogen fluoride, or HF, alkylation is especially applicable in a refinery where additional isobutane charge and low-boiling materials required for gasoline vapor pressure can be obtained at low cost from sources other than cracking, thereby permitting the use of all the low-boiling olefins as charging stock for the production of alkylate. HF consumption is no higher for propylene or amylenes than for the butylenes.

The process is excellent for making 100-plus octane blending components for premium motor fuels and aviation gasolines.

Motor gasoline . . . The HF alkylation process shown schematically in the flow diagram is arranged for the production of motor-fuel alkylate.

In aviation-gasoline production a rerun column, bauxite towers, and a debutanizer, also would be required. Marked improvements have been made recently to simplify design and thereby lower capital and operating costs both in the aviation and motor-gasoline alkylation units. A lower catalyst inventory is required than formerly and plant arrangement and control have been simplified. The contactor has been reduced in size and HF-circulation pumps have been eliminated. The regenerator has been simplified with provisions for improving the purity of the regenerated HF, and the fractionation section rearranged to reduce utility requirements.

Isobutane requirements, yields, and product qualities are shown in Table 1.

Analytical data and antiknock rating interrelationship for a rerun butylene alkylate are shown in Table 2.

Optimum processing arrangement and conditions must be determined for each installation. Installation costs for motor alkylate run as low as $500 per barrel for units of 1,000 bbl. per stream day of 3.5-lb. R.v.p. product.

This process is licensed by Universal Oil Products Co.

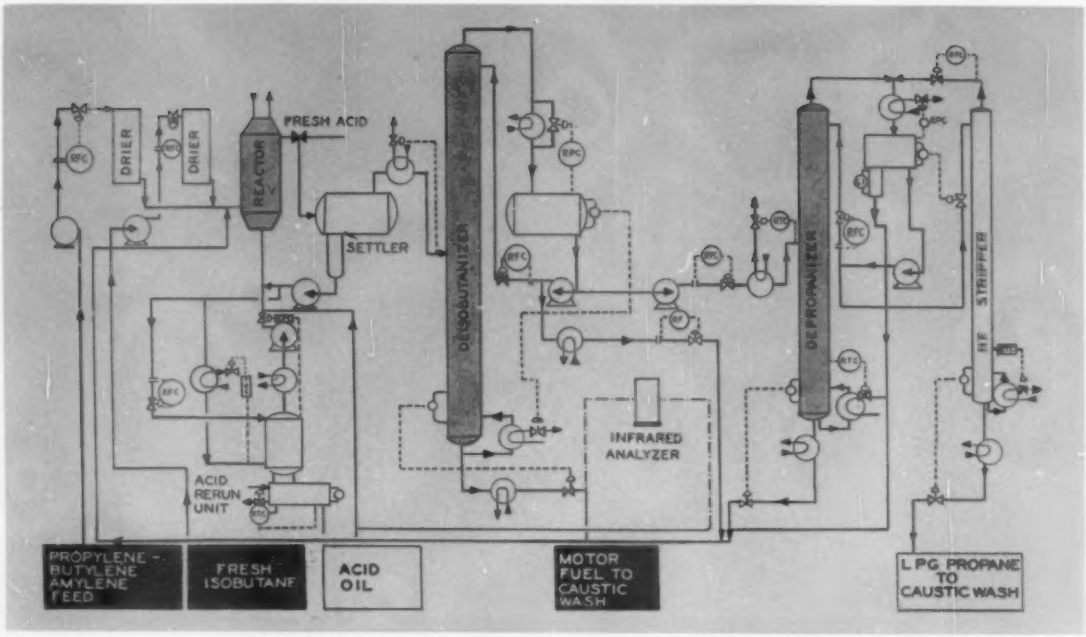
TABLE 1—YIELDS AND PRODUCT QUALITIES FROM HF ALKYLATION

	Vol./Vol. olefin		F-1 Oct. No.*		F-2 Oct. No.*	
	Isobutane	Alkylate	Clear	+3 cc. TEL	Clear	+3 cc. TEL
Butylenes	1.16	1.72	92-95+	102.5-109	92-94	100-104
Propylene	1.35	1.75	90-91	100-104	89-90	99-101

*Octanes over 100 are Wiese scale.

TABLE 2—PROPERTIES OF A RERUN BUTYLENE ALKYLATE

Gravity, °A.P.I.	70.7
Reid vapor pressure, psi.	3.5
Isopentane content, vol. per cent	4.3
Rerun alkylate, vol. per cent of total alkylate	94.7
Engler distillation, °F.:	
I.b.p.	148
10 per cent	197
50 per cent	218
90 per cent	226
End point	275
Antiknock ratings with 4.6 ml. TEL/gal.:	
F-3, iso C_8 + ml. TEL	1.4
F-3, performance number	131.6
F-4, iso C_8 + ml. TEL	3.64
F-4, performance number	150.6



Perco HF Alkylation

THE alkylation of isobutane with olefins such as propylenes, butylenes, or amylenes, using hydrofluoric acid as a catalyst, is a well-established process for producing high-octane-number blending components used in aviation gasoline and motor fuels. Until recently, due to government regulation, most alkylate was utilized in aviation-gasoline rather than motor-fuel blending. With these restrictions removed, and with the ever-increasing demand for higher octane and quality, more and more alkylate will be used in motor fuel.

Essential features of the Perco HF alkylation process are shown in the flow diagram.

As an auxiliary to the operation, an acid rerun unit is provided, where the hydrofluoric acid catalyst is continuously purified by the fractionation of a small portion of the circulating acid stream. The acid-soluble oil production is so small that it can be easily disposed of.

Former Expense Eliminated

Caustic washing is the only treatment employed on motor-fuel alkylate, thus eliminating the former expense of catalytic defluorination. An infrared analyzer records continuously the isobutane content of the recycle isobutane and motor-fuel alkylate. Use of the infrared analyzer results in considerable reduction of isobutane losses to motor fuel and improves alkylate quality by maintaining high-purity isobutane recycle.

The on-stream factor for the modernized Perco HF alkylation unit is approximately 98 per cent. Units are currently operated continuously and trouble-free for periods of 18 to 24 months between turnarounds.

This process is licensed by Phillips Petroleum Co.

Tables 1-3 show typical operating data, cost data, and product properties.

TABLE 1—TYPICAL OPERATION OF HF ALKYLATION
(Based on 100 bbl. per day total feed)

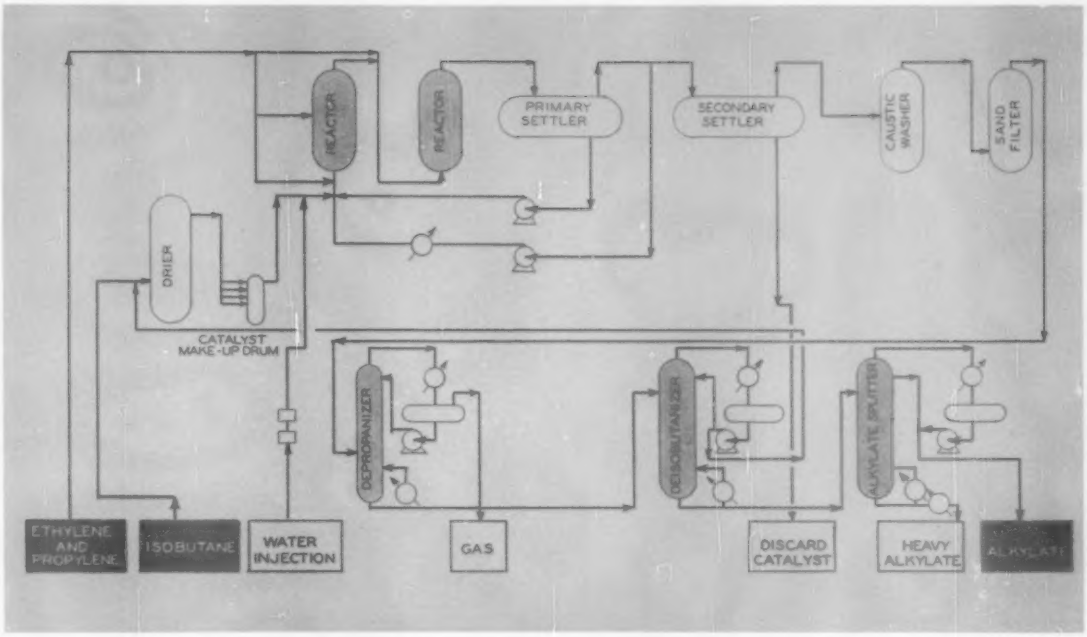
	Bbl.
Charge to unit:	
C_4 fraction from cat cracker:	
Propane	0.9
Propylene	0.9
Butylenes	32.5
Isobutane	40.2
n-Butane	25.5
Total unit feed	100.0
Yields from unit:	
Propane	0.9
Isobutane	1.1
n-Butane	25.5
Alkylate	56.8
Total yield	84.4

TABLE 2—TYPICAL PROPERTIES, DEBUTANIZED MOTOR-FUEL ALKYLATE

Gravity, °A.P.I.	68.8
A.S.T.M. distillation, °F.:	
I.b.p.	160
50 per cent evap.	224
End point	392
A.S.T.M. research octane number:	
+0 ml. TEL	93.1
+1 ml. TEL	100.8
+3 ml. TEL	104.9

TABLE 3—SUMMARY OF DIRECT OPERATING EXPENSE, 98 PER CENT STREAM FACTOR

	Dollars per bbl. alky.
Operating labor	0.0800
Supervision and laboratory	0.0800
Repair labor and materials	0.1600
Utilities	0.1240
Chemicals	0.0660
Total	0.5100



Aluminum Chloride Alkylation

THIS is a liquid phase catalytic process to convert normally gaseous hydrocarbons to high-octane motor fuel. Ethylene, propylene, and isobutane are the charge stocks. The product is a clean-burning, high-octane motor-fuel alkylate.

The basic reaction of the aluminum chloride alkylation process is the reaction of ethylene and propylene with isobutane to produce a high-quality product boiling in the gasoline range. The catalyst employed is aluminum chloride in a complex with hydrocarbons. HCl is used as a promoter and is produced by injecting a controlled amount of water into the reactors.

Dry fresh feed consisting of ethylene, propylene, and isobutane are charged to the reactor. Catalyst is added intermittently to the system by passing the isobutane charge through a catalyst makeup drum. The reactor effluent passes through a primary settler for phase separation of hydrocarbon and catalyst. The catalyst is recirculated to the primary reactor. The smaller portion of hydrocarbon from the primary settler passes to a secondary settler for final removal of any entrained catalyst. A major portion of the effluent hydrocarbon from the primary settler is recycled through a cooler to the first reactor to maintain the desired temperature of the second reactor. The reactors normally operate at fairly constant temperature. The hydrocarbon effluent from the secondary settler is caustic washed before entering the fractionation section.

The fractionation section consists of a depropanizer, deisobutanizer and alkylate splitter. Propane and lighter hydrocarbons are yielded as an overhead gas from the depropanizer, isobutane is yielded overhead from the deisobutanizer and recycled to the reactors, the motor fuel alkylate is fractionated for end point in the alkylate splitter.

Information about aluminum-chloride alkylation may be obtained from Phillips Petroleum Co., Bartlesville, Okla.

TYPICAL OLEFIN FEED ANALYSIS

Component—	Mol %	Component—	Mol %
Methane	12.5	Propane	2.7
Ethylene	45.2	Butane	0.7
Ethane	15.8		
Propylene	23.2	Total	100.0

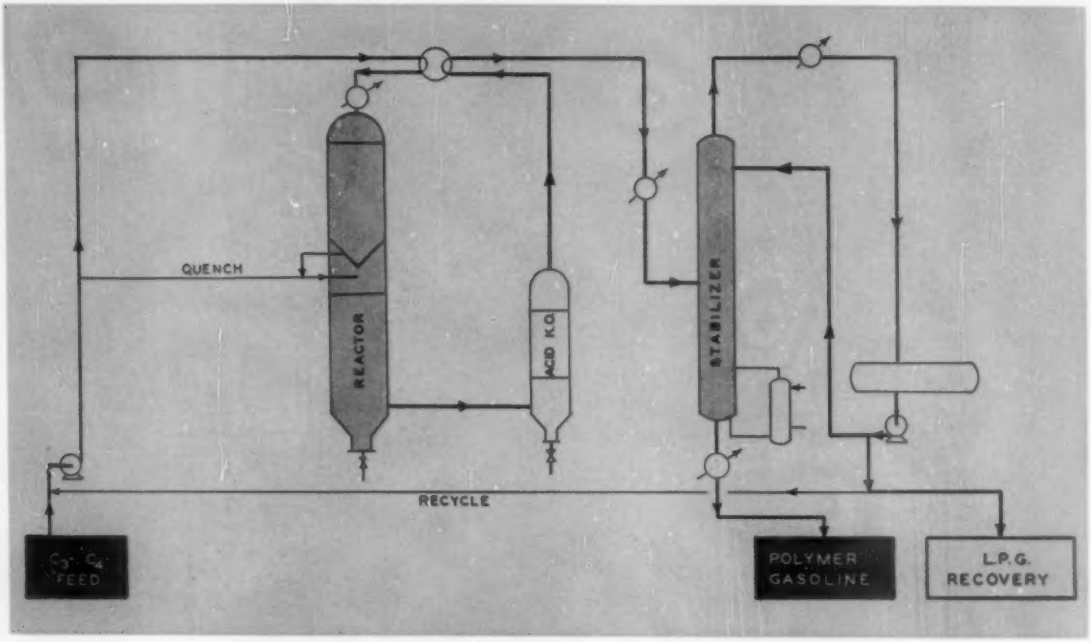
TYPICAL PROPERTIES OF MOTOR-FUEL ALKYLATE

Per cent of total alkylate	95.0
R.v.p. (undebutanized)	9.0
°A.P.I.	74.0
A.S.T.M. distillation, °F.:	
I.b.p.	110
10 per cent	129
20 per cent	140
50 per cent	159
90 per cent	300
95 per cent	363
E.p.	425
A.S.T.M. research octane number:	
Clear, 0 ml. TEL	59.1
1 ml. TEL	*102.7
3 ml. TEL	†109.5

*Equivalent of A.S.T.M. research method rating of 0.15 ml. TEL in isooctane. †Equivalent of A.S.T.M. research method rating of 1.10 ml. TEL in isooctane.

REPRESENTATIVE COST FIGURES

	Unit/bbl. total alkylate
Utilities—	
Steam (million B.t.u. absorbed)	0.44
Cooling-water circulation, 1,000 gal., 20° rise	2.6
Makeup water, 1,000 gal.	0.08
Power, kw.-hr.	3.3
Chemicals—	
Caustic, lb.	0.015
Aluminum chloride, lb.	2.80



Polymerization

THE polymerization process of California Research Corp. produces a gasoline blending stock of high octane rating and blending value from propylene and butylenes. The reaction takes place in fixed-bed vessels at a pressure of about 500 psi. and temperatures from 275°-375° F. Usual design is for an average 90 per cent conversion of the olefins in the feed. Sulfur and nitrogen compounds are catalyst poisons and are removed from the plant feed by caustic and water scrubbing. The catalyst consists of a thin film of phophoric acid distributed over fine-mesh quartz.

Preparation of the catalyst is simple. Reactors are packed with fine-mesh quartz and then filled with phosphoric acid. Acid is allowed to drain off leaving a thin film of phosphoric acid on the quartz. To regenerate the catalyst, a reactor is washed with water, steamed, and dried in place, then again recoated with phosphoric acid.

The polymers produced by the California polymerization process have a 94.5 to 100 F-1 clear octane rating and an even higher blending knock rating. In the concentrations usually employed, the effective concentration is 1.5-2.0 times the actual.

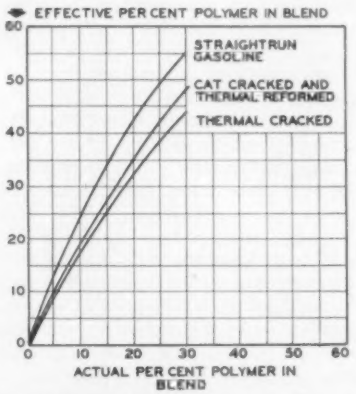
Leaded polymers exhibit the same general characteristics when blended with leaded base stocks, provided the sulfur and lead contents of the base stocks are at the level of the polymer. Characteristics of the polymer can be influenced by operating conditions.

The first large-scale plant was built in 1937 at the Richmond refinery of Standard Oil Co. of California. There are now 36 plants in operation and using the process and 5 plants under construction. Total design polymer production exceeds 30,000 bbl. per day.

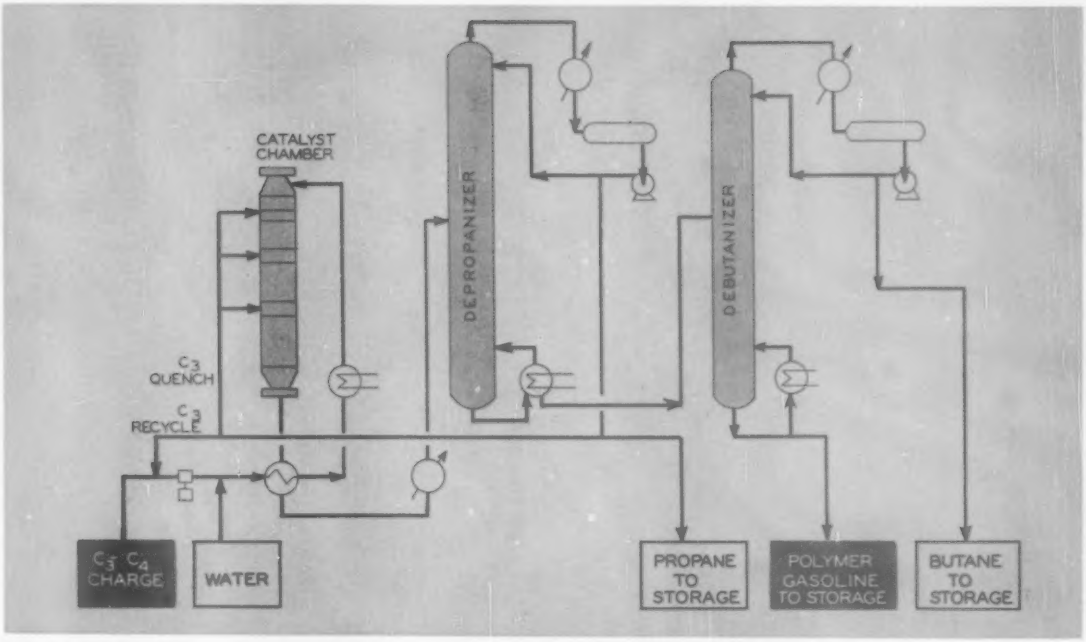
TABLE 1—INSPECTIONS OF TYPICAL POLYMER GASOLINES

	Propene* polymer	Propene-butene* polymer
Gravity, °A.P.I.	57.1	63.0
Sulfur, per cent	<0.01	<0.01
Reid vapor pressure, psi.	0.8	2.6
Octane number:		
F-1 clear	94.5	96.0
F-1 + 3 ml. TEL	99.5	100.0
A.S.T.M. distillation, °F.:		
I.b.p.	180	130
10 per cent	251	215
50 per cent	305	252
90 per cent	390	365
E.p.	453	440

*Debutanized.



OCTANE - BLENDING BEHAVIOR of polymer in terms of effective concentration vs. actual concentration in motor gasoline stocks.



Phosphoric Acid Condensation

THE great expansion of the petrochemical industry has added tremendously to the uses of the U.O.P. solid phosphoric acid catalyst. It is well recognized as an outstanding catalyst for producing high-octane motor fuel from refinery butylenes and propylene. It also is an important polymerization catalyst for the production of valuable chemical polymers such as tetramer, C_6-C_9-C_{15} olefins for the production of alcohols and sulfonates, and as an alkylation catalyst for the production of cumene, ethyl benzene, secondary butyl benzene, diisopropyl benzene.

Chamber units . . . Recent advances in engineering have reduced the capital costs and increased the efficiency of the chamber-type polymerization units such that there are now more chamber-type units being designed than the "reactor" or tubular type of unit. It is these chamber-type units that are now being widely used in the petroleum field.

The products now being produced or under consideration for these units are tetramer, cumene, ethyl benzene, secondary butyl benzene, diisopropyl benzene, and C_6-C_9-C_{15} olefins for the production of alcohols and sulfonates.

Products . . . The flow chart shows a polymerization unit for C_3-C_4 motor polymer. A rerun column is added when producing tetramer or alkyl aromatics such as cumene on this unit. Tetramer is the basic material for the alkyl aryl sulfonate type of detergent and cumene is now used as a basic material for the production of phenol and acetone.

The hydrocarbon charge is mixed with water and passed into the catalyst chamber. Reaction conditions are controlled here by means of a propane quench. Reactor effluent passes to a depropanizer and propane product, propane for recycle, and quench propane are taken off the top of this column.

Yields normally correspond to 90-97 weight per cent of olefins converted to motor polymer when charging C_3-C_4 olefins from thermal and catalytic cracking. Properties of some of the products are shown in the table.

In the production of tetramer, propylene motor polymer and tetramer bottoms also are produced. The motor polymer yield varies from 1 to 25 liquid volume per cent and the bottoms yield from 2-4 liquid volume per cent of the total polymer produced. These percentages vary because of the various tetramer specifications.

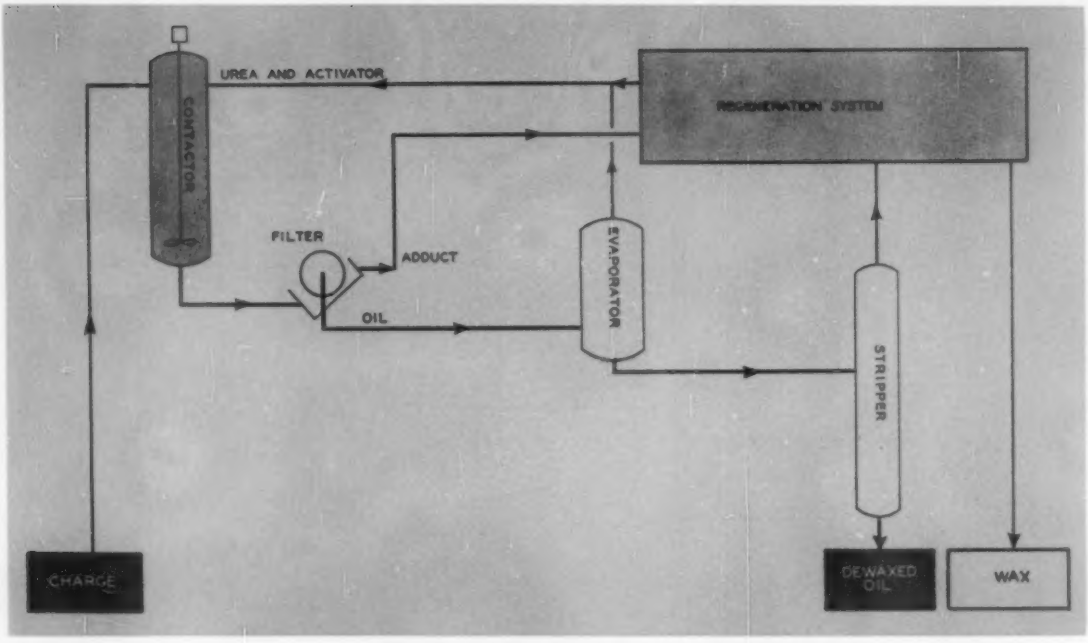
When cumene is produced, approximately 96 volume per cent of the propylene and benzene feed is yielded as cumene; the remainder, 4 per cent as heavier aromatics, constitutes rerun bottoms.

This process is licensed by Universal Oil Products Co.

PROPERTIES OF PRODUCTS

	C_3 motor polymer	C_3-C_4 polymer	Tetramer	Cumene
R.v.p.	4.4	9.2	0.0	0.0
Gravity, °A.P.I.	59.5	66.1	51.0	32.1
				A.S.T.M. aromatic dist.
A.S.T.M. Engler dist.:				
I.b.p.	136	96	353	301
5 per cent	...	130	...	302
10 per cent	228	149	361	302
30 per cent	258	201	...	302.5
50 per cent	276	228	371	303
70 per cent	292	263	...	303
90 per cent	338	348	397	303
End point	420	422	450	*304
Research octane with 3 ml. TEL	99.5	100	...	...

*Dry point.



Urea Dewaxing

UREA dewaxing, developed by Standard Oil Co. (Indiana), is a continuous process producing oils of very low pour point from crudes which contain wax. Straight-chain paraffins which form wax are removed by treatment with urea. Urea forms a solid complex with the wax which is readily separated to produce a raffinate oil of very low pour point.

Urea dewaxing is a highly selective process which, in contrast to other dewaxing techniques, is carried out without the use of refrigeration.

Charge . . . Oils of relatively low wax content and oils which have been partially dewaxed by conventional solvent processes are particularly suitable. In general, the charge has a viscosity ranging from about 50 to 220 S.U.s. at 100° F.

Product . . . Urea dewaxed oils are particularly useful for refrigerator oils, transformer oils, automatic-transmission fluid, hydraulic fluid, and lubricants for Arctic service. The product will usually vary in pour point from about —55° to about —25° F., depending on the charge and the process conditions used.

Description . . . Charge, urea, and an activator are continuously introduced to a stirred contactor. Urea forms an adduct with the waxy paraffins in the charge. Effluent from the contactor is charged to a filter where the adduct is separated. Reagents used in the process are separated from the raffinate oil by evaporation and stripping to produce finished product. The solid complex from the filter is decomposed in the regeneration system. Urea is recovered for recycle to the contactor and byproduct wax is produced as extract. A unique feature of the Urea dewaxing process is that no refrigeration is required; the process operates at ordinary temperatures.

Results . . . The accompanying table shows feed and product inspections and yield data for feeds of 59, 82, and 229 S.U.s. viscosity at 100° F.

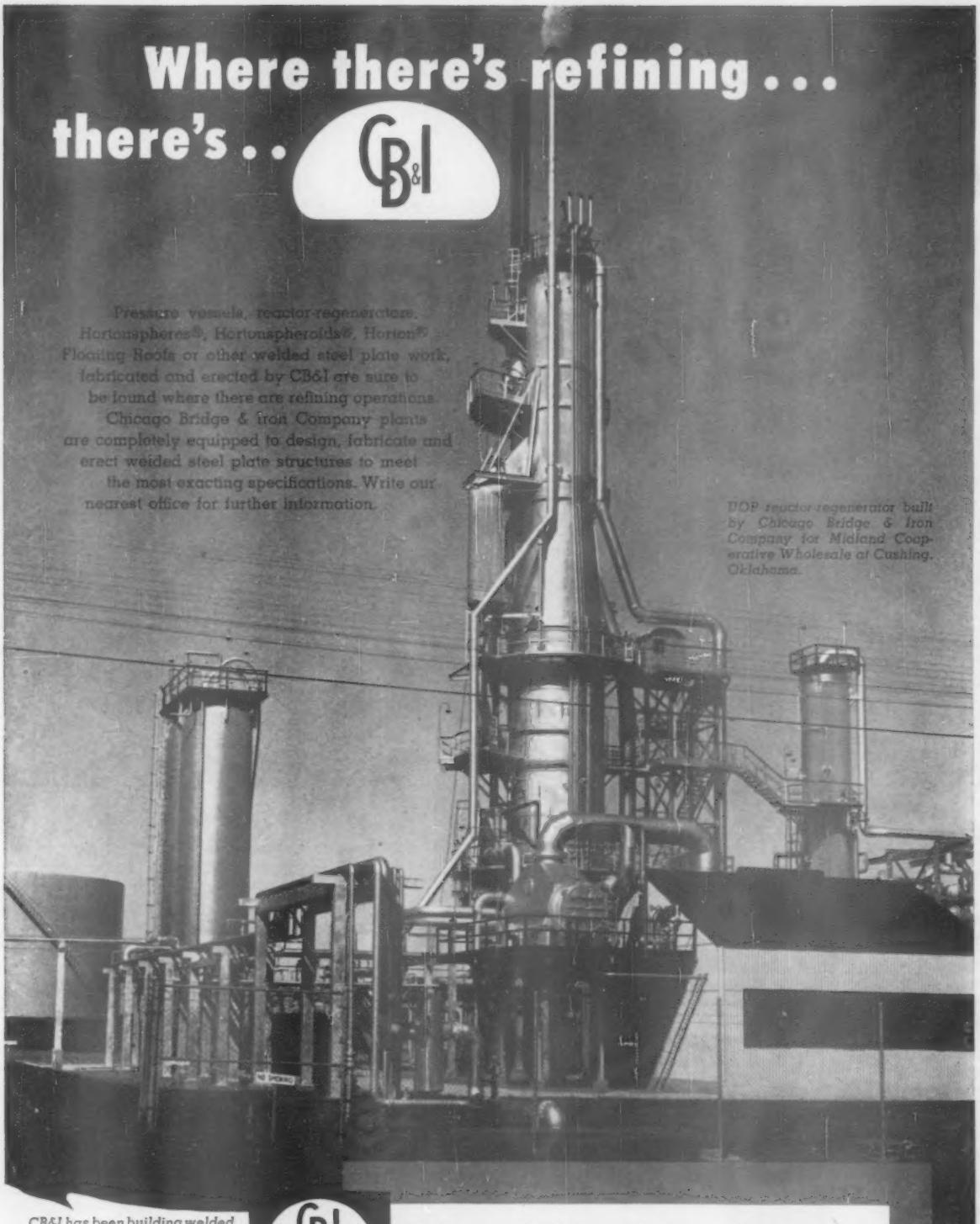
Costs . . . Process facilities for Urea dewaxing cost approximately $900 per daily barrel of charge. Operating costs are about 2 to 2½ cents per gallon of charge.

Commercial units . . . A 1,000-bbl. per day commercial unit was commissioned at the Whiting refinery of Standard Oil Co. (Indiana) early in January 1957.

TABLE 1—INSPECTIONS OF FEEDS AND PRODUCTS

	59 S.U.s. feed			82 S.U.s. feed		229 S.U.s. feed		
	Feed	Product	Byproduct	Feed	Product	Feed	Product	Byproduct
Gravity, °A.P.I.	30.5	29.0	46.1	28.6	26.9	26.0	25.6	40.8
Viscosity, S.U.s. at 100° F.	59	64	44.0	82	92	229	246	68.1
Viscosity, S.U.s. at 210° F.	35	35	32.4	37	38	51	47	37.8
Viscosity index	78	69	139	75	61	66	64	167
Pour point, °F.	15	—55	75	35	—40	0	—25	80
Color, NPA	5-6	6-7	.....	2½-3	3-3½	2	2½	.....
Refractive index	1.4858	1.4898	1.4449	1.4906	1.4953	1.4990	1.5002	1.4579
Adductable content, weight per cent	10	.....	.....	7	.....	4	.....	.....
Yield, volume per cent	.....	85	.....	.....	89	.....	.....	94

Where there's refining . . . there's . . CB&I



Pressure vessels, reactor-regenerators, Hortonspheres®, Hortonspheroids®, Horton® Floating Roofs or other welded steel plate work, fabricated and erected by CB&I are sure to be found where there are refining operations. Chicago Bridge & Iron Company plants are completely equipped to design, fabricate and erect welded steel plate structures to meet the most exacting specifications. Write our nearest office for further information.

DOP reactor-regenerator built by Chicago Bridge & Iron Company for Midland Cooperative Wholesale at Cushing, Oklahoma.

CB&I has been building welded steel plate structures for the petroleum industry for over 65 years.

CB&I

Chicago Bridge & Iron Company

Atlanta • Birmingham • Boston • Chicago • Cleveland • Detroit • Houston
Los Angeles • New York • Philadelphia • Pittsburgh • Salt Lake City
San Francisco • Seattle • Tulsa • Washington
Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY and GREENVILLE, PA.

JOURNAL SURVEY OF REFINERIES IN UNITED STATES

Location and Capacities as of January 1, 1957

State—	No. plants	Crude capacity B.P.C.D.	Crude capacity B.P.S.D.	Charge, bbl. per stream day: Vacuum dist.	Thermal operations	Catalytic cracking, total feed	Catalytic reforming	Hydro-treating	Production, bbl. per stream day: Alkylation	Polymerization	Lubes	Coke (tons)	Asphalt*: (1)	(2)	(3)	(1-2-3)
Alabama	4	13,800	14,950	8,700									7,818	1,550	2,300	
Arkansas	6	79,300	83,200	27,400	13,000	39,000	6,120		2,750	900	3,900	400	5,200	1,600		
California	36	1,210,480	1,291,700	487,750	67,965	402,160	154,975	147,990	43,818	3,995	21,860	3,560	41,185	7,315	2,100	22,589
Colorado	7	35,450	37,750	6,000	6,350	12,250	650			850			1,500			
Delaware	2	127,000	133,680	85,500	42,000	102,000	45,000	88,000	5,000	5,100		1,200				1,665
Florida	1	2,000	2,100										1,100	250		
Georgia	1	6,500	7,000										3,800	1,500		
Illinois	14	548,000	576,600	147,500	161,615	254,600	98,735	37,685	25,684	10,724	5,073	1,804	12,735	1,200	1,800	5,772
Indiana	9	447,400	469,300	100,500	176,600	165,000	76,150	22,500	11,410	4,250	10,750	1,370	9,900	9,000	2,500	
Kansas	14	296,800	314,100	93,200	57,470	168,250	46,200	7,000	4,150	9,750	3,900	435	19,250	1,800	990	
Kentucky	4	100,000	106,300	34,000	21,500	39,900	8,500	10,000		3,350				8,500	1,000	
Louisiana	15	778,685	816,180	213,265	97,900	404,200	72,960		39,700	11,480	10,070	400	16,540	1,195	330	
Maryland	3	83,450	92,500	19,900	16,000	60,500	3,000	17,000	4,520			350	16,500	3,900	4,300	
Massachusetts	1	50,000	55,000	13,100	15,000	24,500				1,800			4,900	5,100		
Michigan	15	159,150	167,850	30,000	32,300	55,750	28,150	19,700		2,660		300	6,500	600		
Minnesota	4	54,500	57,000	6,000	10,000	40,000	5,000	16,000		2,470		550				
Mississippi	2	10,700	11,200	5,100	2,000					120			2,250	1,800	1,800	
Missouri	1	74,300	76,000	7,200	56,000	32,000	14,000	20,000		1,800		505	1,000	100	2,700	
Montana	11	73,140	80,187	22,275	20,700	46,500	4,100	7,800		2,353		210	8,580		300	
Nebraska	2	3,100	3,200		1,000		650									
New Jersey	6	431,300	453,200	156,100	50,490	218,850	46,320	49,980	5,876	9,775	8,300		17,000	6,100	1,300	
New Mexico	8	29,900	32,575	2,500	6,235	6,000	3,450	1,000		480			1,400			
New York	5	104,500	110,700	21,300	8,000	56,000	9,000			3,200	2,500		630	4,950		
North Dakota	3	37,500	39,000	1,200	750	24,200	6,200			4,465						
Ohio	12	399,350	430,340	76,900	110,770	202,920	67,317	27,000	7,454	8,670	4,300	675	10,100	8,700	4,000	
Oklahoma	15	368,375	383,420	111,830	100,690	191,015	37,860	9,880	10,300	9,765	11,150	1,230	4,100	†5,000	1,000	
Oregon	4	3,500	6,500	6,500									4,200	900	1,150	
Pennsylvania	13	645,850	680,195	210,200	100,340	286,880	92,020	14,400	16,964	8,032	31,173	30	9,713	1,665		
Rhode Island	1	3,500	3,680	1,840												1,665
South Carolina	1	8,000	8,700	6,800									4,100	400		
Tennessee	2	6,100	6,800	1,240		3,000				250						
Texas	57	2,453,955	2,619,980	580,400	599,145	946,550	377,680	282,180	87,533	24,892	67,260	544	23,155	500	1,000	16,760
Utah	6	85,265	88,560	28,700	10,700	47,500	6,500		3,500	1,200	120		2,900			
Virginia	1	34,100	35,000	19,000	9,600	30,600				2,500		600				
Washington	4	90,000	98,500	33,500	6,600	43,000	14,500	8,400		5,000			6,100	2,100		
West Virginia	2	6,671	7,300	1,500	2,850		2,500	500		175	1,800					
Wisconsin	2	13,500	14,900	5,200	1,500		1,000						3,580			
Wyoming	11	109,665	117,015	28,720	22,740	45,540	12,490	8,940	2,500	2,205	650	229	9,650	550	2,500	1,554
Puerto Rico	2	34,595	37,020	22,800		39,900	3,730		1,460	1,400						
Total	304	9,019,381	9,569,182	2,623,620	2,327,810	3,988,565	1,244,757	795,955	272,619	143,611	182,806	14,392	255,386	76,275	31,070	50,005

*Asphalt is reported thus: (1) straightrun; (2) oxidized; (3) other; (1-2-3) combined straightrun, oxidized, and other. †Includes 2,500 bbl. combined (1) and (2).

Location of Plants, Capacities, and Types of Processing

Processes in table are identified by numbers. Here's what the numbers mean . . .

CATALYTIC CRACKING AND PER CENT RECYCLE
(Per cent recycle based on total feed)
1. Fluid
2. Thermofor
3. Houdriflow
4. Houdry
5. Houdrisid
6. Cycloversion

THERMAL PROCESSES
1. Gas Oil Cracking
2. Visbreaking
3. Naphtha Reforming
4. Coking
5. Fluid Coking
6. Delayed Coking
7. Batch Coking
8. Polyforming
9. Cracking, General
10. Residuum Cracking

CATALYTIC REFORMING
1. Platforming
2. Fluid Hydroforming
3. Fixed-Bed Hydroforming
4. Houdriforming
5. Ultraforming
6. Catforming
7. Thermofor
8. Sinclair-Baker
9. Sovaforming
10. Powerforming
11. Rexforming
12. Iso-Plus
13. Hyperforming
14. Cycloversion

ALKYLATION
1. Sulfuric
2. Hydrofluoric

POLYMERIZATION
1. Thermal
2. Catalytic

CATALYTIC HYDROGENATION
1. Unifining
2. Hydrofining, Esso Research
3. Hydrotreating
4. Hydrodesulfurization
5. Gulfining
6. Sovafining
7. Houdry
8. Shell, Trickle
9. Diesulforming
10. Hydrofining, Indiana
11. "Own"
12. Sinclair
13. Shell Vapor Phase
14. Kellogg
15. Platreating

ASPHALTS
1. Straightrun
2. Oxidized
3. Other

Note: In converting crude-capacity figures from stream day to calendar day, a factor of .95 was used; for process figures, a factor of .90 was used.

Company and location	Crude capacity B.P.C.D.	Crude capacity B.P.S.D.	Charge, bbl. per stream day: Vacuum dist.	Thermal operations	Cat cracking: Total feed	Cat cracking: Per cent recycle	Catalytic reforming	Hydro. treating	Production, bbl. per stream day: Alkylation	Polymerization	Lubes	Coke (tons)	Asphalt
Alabama													
American Bitumuls & Asphalt Co.: Mobile	5,000	6,000	6,000										[1]4,800 [2]900 [3]2,300
Hunt Oil Co.: Tuscaloosa	5,200	5,200	2,700										[1]1,100 [2]300
Vulcan Asphalt & Refining Co.: Cordova	1,850	2,000											[1]1,018
Warrior Asphalt Corp.: Holt	1,750	1,750											[1]900 [2]350
Total	13,800	14,950	8,700										11,668
Arkansas													
American Oil Co. (formerly Pan-Am Southern Corp.): El Dorado	38,400	40,000	20,000	[1]3,000 [5]10,000	[1]21,500	20.0	[5]6,120		[2]1,500	[2]500		400	
Berry Asphalt Co.: Stephens	2,000	2,200	2,200										[1]500
Waterloo	1,200	1,500	1,500								500		[1]600
Cross, Henry H., Co.: Smackover	6,000	6,300	1,200								700		[1]700
Lion Oil Co., Div. Monsanto Chemical Co.: El Dorado	28,000	29,000			[1]11,000 [2]6,500	45.0 0			[1]1,250	[2]400	1,000		[1]3,400 [2]500
Macmillan Petroleum Corp.: Norphlet	3,700	4,200	2,500								1,700		[2]1,100
Total	79,300	83,200	27,400	13,000	39,000		6,120		2,750	900	3,900	400	6,800

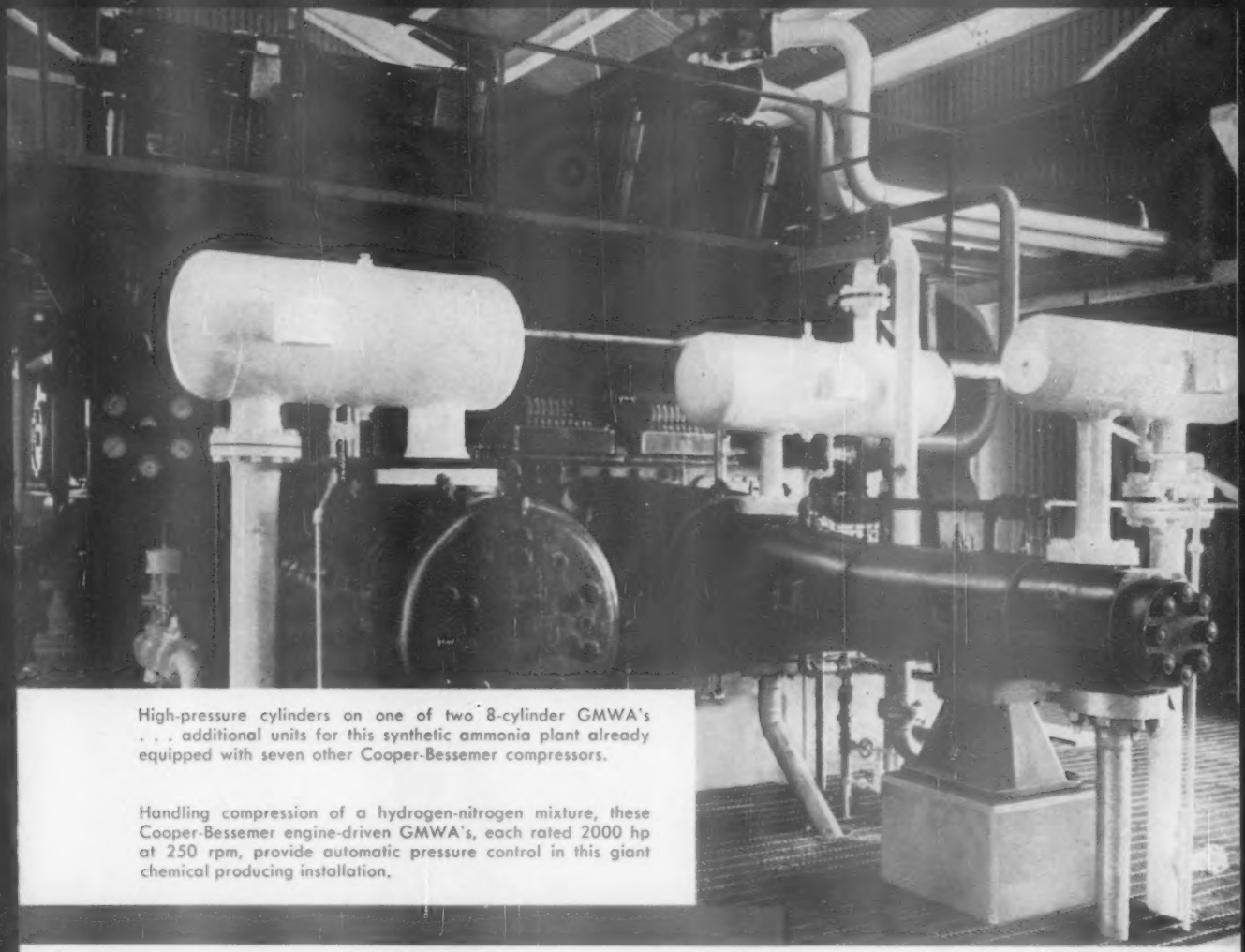
Full-load operation . . . all the time! with Cooper-Bessemers in high-pressure ammonia service

Another Example of Efficient Power at Lower Cost

ANGLE

Compressors

New York City Washington, D. C. New Orleans Los Angeles and San Francisco
Houston, Dallas, Gregg̊ton, Pampa and Odessa, Texas Seattle Tulsa Shreveport St. Louis Chicago



High-pressure cylinders on one of two 8-cylinder GMWA's . . . additional units for this synthetic ammonia plant already equipped with seven other Cooper-Bessemer compressors.

Handling compression of a hydrogen-nitrogen mixture, these Cooper-Bessemer engine-driven GMWA's, each rated 2000 hp at 250 rpm, provide automatic pressure control in this giant chemical producing installation.

• When it comes to compressor horsepower, this Texas synthetic ammonia plant has an important advantage in common with scores of other plants throughout this country and abroad . . . they all benefit from the low maintenance, high operating efficiency of Cooper-Bessemer compressors.

The plant shown here, for example, recently added two 2000 hp Cooper-Bessemer GMWA's to meet increased work demands. This one plant now boasts more than 10,000 Cooper-Bessemer horsepower to effectively handle recirculation and the processing of a hydrogen-nitrogen mixture, through five stages, from 2.5 to 5300 psig.

Since Cooper-Bessemers are especially designed to easily handle the most severe work demands, full-time at full-load operation presents no handicap to the smooth service delivered by these work-wise units.

Whether your requirements include heavy-duty compressors for chemical, petrochemical or virtually any other type service, you'll profit by contacting the nearest Cooper-Bessemer office. Let one of our experienced sales-engineers tell you about the latest developments now being offered by one of America's oldest engine and compressor builders . . . Cooper-Bessemer.

by **Cooper-Bessemer**

MOUNT VERNON, OHIO AND GROVE CITY, PENNA.
Cooper-Bessemer of Canada, Ltd.
11304, 119th St., Edmonton and 615 Second St., S.W., Calgary, Alberta, Canada

Company and location	Crude capacity B.P.C.D.	Crude capacity B.P.S.D.	Charge, bbl. per stream day: Vacuum dist.	Charge, bbl. per stream day: Thermal operations	Charge, bbl. per stream day: Cat cracking: Total feed	Charge, bbl. per stream day: Cat cracking: Per cent recycle	Charge, bbl. per stream day: Catalytic reforming	Charge, bbl. per stream day: Hydro. treating	Production, bbl. per stream day: Alkylation	Production, bbl. per stream day: Polymerization	Production, bbl. per stream day: Lubes	Production, bbl. per stream day: Coke (tons)	Production, bbl. per stream day: Asphalt
California													
Bankline Oil Co.:													
Bakersfield	11,400	12,000		[1]3,000 [5]4,000					[1]1,000			40	
Caminol Co.:													
Hanford	6,000	6,000	2,000	[1]550 [2]2,000 [3]250						[2]100			
Century Oil Co.:													
Long Beach	5,000	5,000											
Douglas Oil Co. of California:													
Bakersfield	7,000	7,500		[1]4,600			[1]2,200						
Paramount	7,000	7,000	5,200										[1]3,500 [3]3,500
Santa Maria	3,500	3,500	2,800										[1]2,800
Edgington Oil Refineries, Inc.:													
Long Beach	7,000	7,000											[1]1,500 [2]1,000
Oxnard	2,500	2,500											[1]1,750
Fletcher Oil Co.:													
Wilmington	5,000	5,000		[1]5,000									
General Petroleum Corp.:													
Torrance	125,000	128,000	38,000	[2]26,500 [6]26,000	[2]55,000	50.0	[7]16,000		[2]3,700	[2]600		1,100	
Golden Bear Oil Co.:													
Oildale	3,950	4,000									2,100		[1]1,360
Hancock Oil Co.:													
Signal Hill	20,000	21,000	15,750	[1]1,000 [2]9,450	[2]12,100	42.0	[3]3,000	[4]3,000		[2]500			
Macmillan Petroleum Corp.:													
Long Beach	8,000	9,000									200		[1]2,700
Mohawk Petroleum Corp.:													
Bakersfield	11,000	11,800		[1]800 [3]3,500			[1]2,500			[1]65			
Newhall Refining Co.:													
Newhall	2,000	3,000											[1]1,200 [2]200
Oznard Oil & Refining Co.:													
Oxnard	1,800	1,800											[1]1,000
Palomar Oil & Refining Corp.:													
Bakersfield	1,230	1,300									390		[1]485 [2]100
Richfield Oil Corp.:													
Wilmington (Watson plant)	129,500	136,500	63,000	[1]23,000 [2]29,000	[1]63,000 [2]30,000	35.0 35.0	[8]17,000	[1]8,000 [2]17,000	[1]7,000	[2]1,900			[1]2,690 [2]765 [3]2,000
Rothschild Oil Co.:													
Santa Fe Springs	9,000	10,000		[1]5,000			[1]1,000			[2]150			
Seaside Oil Co.:													
Ventura	3,800	4,500											
Shell Oil Co.:													
Martinez	55,000	58,000	11,600	[2]33,000			[1]5,800				3,300		[1]4,400
Wilmington-Dominguez	79,000	83,000	47,000	[2]36,000	[1]25,000	0	[1]4,000	[1]12,600	[1]5,800				
Socal Oil & Refining Co.:													
Huntington Beach	2,500	2,500		[2]1,800									[1]200
Standard Oil Co. of California:													
Bakersfield	20,000	22,200		*[1]9,000									*[1 2 3]1,100
El Segundo	122,000	135,600	*54,000	*[3]11,000 *[1]59,000	*[1]36,000	10.0	*[1]30,000	*[1]20,500	*[1]5,400				*[1 2 3]8,250
Richmond	165,000	183,400	*25,000	*[2]7,500 *[1]50,000	*[2]32,000	0	*[1]20,000 *[2]12,500	*[1]20,000	*[2]4,000		*[1]0,000		*[1 2 3]11,000

Speed

Brown and Root's record
of early project completion
means a bonus of unexpected production;
which in analysis,
presents a reduction in
plant cost.

BROWN & ROOT, INC.
Engineers • Constructors
POST OFFICE BOX 3, HOUSTON 1, TEXAS

No. One Wall Street, New York 5, New York
Brown & Root de Mexico, S.A. de C.V., Mexico City, Mexico
Brown & Root Construcciones, S.A., Caracas, Venezuela
Brown & Root, Ltd., Edmonton, Alberta, Canada
Brown & Root, S.A., Panama City, Panama

CABLE ADDRESS—BROWNBILT

Congrats and $25 to LOCKWOOD H. POOL, 424 Shell Bldg., New Orleans, La., for this quip.

"...thinks a female connection is a steady date."

The oil country has a whopping big appetite for pipe. Lone Star Steel's huge plant was built for the specific purpose of supplying fully normalized *API casing, tubing and line pipe* to Joe Roughneck, heart of the oil and gas industry. As fast as we can make it, he gets it!

Now . . . we're building again . . . our new stretch-reducing mill and another open hearth furnace. Goal: more fine steel and more pipe . . . to help Joe meet the greater domestic and export demand for petroleum.

Neighbor, wherever you are, specify Lone Star and we both get a good deal.

Lone Star STEEL COMPANY

LSS

EXECUTIVE SALES OFFICES
W. Mockingbird Lane at Roper • P. O. Box 12226 • Dallas, Texas

DISTRICT SALES OFFICES

Houston, Texas | Midland, Texas | San Antonio, Texas
Tulsa, Oklahoma | Wichita Falls, Texas | Shreveport, La.

REFINERY SURVEY (CALIFORNIA Continued)

Company and location	Crude capacity B.P.C.D.	Crude capacity B.P.S.D.	Charge, bbl. per stream day: Vacuum dist.	Thermal operations	Cat cracking: Total feed	Cat cracking: Per cent recycle	Catalytic reforming	Hydro. treating	Production, bbl. per stream day: Alkylation	Polymerization	Lubes	Coke (tons)	Asphalt
Sunland Refining Corp.:													
Bakersfield	4,500	4,500		[2]1,100									
Sunset International Petroleum Corp. (formerly Sunset Oil Co.):													
Torrance	9,000	9,500		[2]3,200						[1]80			
Texas Co., The:													
Wilmington	60,000	(‡)	[*]35,000	[*][1]10,000	[*][1]28,000	(‡)	[*][1]10,000	[*][1]9,000	[*][1]4,400				
Tidewater Oil Co.:													
Avon	108,300	114,000	54,000	[1]17,600 [2]27,000 [5]42,000	[1]45,000	0	[1]10,000	[1]34,500	[1]6,000		1,670	1,200	
Union Oil Co. of California:													
Arroya Grande (Santa Maria plant)	21,500	24,500		[6]15,000								720	
Bakersfield (Maltha plant)	8,100	8,800											[1]1,950
Rodeo (Oleum plant)	43,800	46,100	28,000	[1]15,000 [6]13,000			[1]13,000	[1]18,500			3,100	500	[1]5,000
Santa Maria (Orcutt plant)	4,700	5,000	1,500	[2]2,500									[1]1,400 [2]450
Wilmington (L.A. plant)	109,000	115,000	87,000	[1]16,000 [2]18,500 [3]8,000	[1]34,000 [2]24,000	19.0 25.0			[1]5,000				[1]5,750 [2]1,400
Wilshire Oil Co. of California:													
Norwalk	28,400	30,000	12,000	[1]12,000	[1]7,500	5.0				[2]600			[1]3,500
Total†	1,210,480	1,291,700	487,750	567,965	402,160		154,975	147,990	43,818	3,995	21,860	3,560	73,183

*Barrels per calendar day. †State totals include crude capacity figures not reported, and calendar day figures converted to stream day. ‡Not reported.

Colorado

Company and location	Crude capacity B.P.C.D.	Crude capacity B.P.S.D.	Charge, bbl. per stream day: Vacuum dist.	Thermal operations	Cat cracking: Total feed	Cat cracking: Per cent recycle	Catalytic reforming	Hydro. treating	Production, bbl. per stream day: Alkylation	Polymerization	Lubes	Coke (tons)	Asphalt
Bay Petroleum Corp., The:													
Denver	10,000	10,500	4,000		[1]5,000	20.0				[2]350			
Continental Oil Co.:													
Denver	11,250	12,250		[2]2,150 [3]1,100	[2]7,250	38.5				[2]500			
Empire Petroleum Co.:													
Denver	6,300	7,000	2,000										[1]1,500
Oriental Refining Co.:													
Alamosa	1,000	1,000		[1]600									
Denver	3,500	3,500		[1]1,500									
Skelly Oil Co.:													
Denver	1,400	1,500		[1]800			[1]650						
Wesco Refining Co.:													
Rangely	2,000	2,000		[2]200									
Total	35,450	37,750	6,000	6,350	12,250		650			850			1,500

Delaware

Company and location	Crude capacity B.P.C.D.	Crude capacity B.P.S.D.	Charge, bbl. per stream day: Vacuum dist.	Thermal operations	Cat cracking: Total feed	Cat cracking: Per cent recycle	Catalytic reforming	Hydro. treating	Production, bbl. per stream day: Alkylation	Polymerization	Lubes	Coke (tons)	Asphalt
Texas Co., The:													
Claymont	3,500	(*)	[1]1,750										[1,2,3]1,500
Tidewater Oil Co.:													
Delaware City	(*)	130,000	83,700	[2]42,000	[1]102,000	43.1	[1,2]45,000	[1]88,000	[1]5,000	[2]5,100		1,200	
Total*	127,000	133,680	85,500	42,000	102,000		45,000	88,000	5,000	5,100		1,200	1,665

*State totals include crude capacities not reported, and calendar day figures converted to stream day. †Barrels per calendar day.

Florida

Company and location	Crude capacity B.P.C.D.	Crude capacity B.P.S.D.	Charge, bbl. per stream day: Vacuum dist.	Thermal operations	Cat cracking: Total feed	Cat cracking: Per cent recycle	Catalytic reforming	Hydro. treating	Production, bbl. per stream day: Alkylation	Polymerization	Lubes	Coke (tons)	Asphalt
Seminole Asphalt & Refining, Ltd.:													
St. Marks	2,000	2,100											[1]1,100 [2]250

Company and location	Crude capacity B.P.C.D.	Crude capacity B.P.S.D.	Charge, bbl. per stream day: Vacuum dist.	Thermal operations	Cat cracking: Total feed	Cat cracking: Per cent recycle	Catalytic reforming	Hydro. treating	Production, bbl. per stream day: Alkylation	Polymerization	Lubes	Coke (tons)	Asphalt
Georgia													
American Oil Co.:													
Savannah	6,500	7,000											[1]3,800 [2]1,500
Illinois													
Advance Refining Co., Inc.:													
Centralia	2,400	2,500			[4]450	10.0							
Calumet Refining Co.:													
Burnham	1,000	1,200									750		[1]185
Clark Oil & Refining Corp.:													
Blue Island	30,000	32,000	7,000	[1]1,200	[3]7,000	20.0	[1]5,000			[3]800			
Cross, Henry H., Co.:													
Colmar	1,000	1,100											
Ohio Oil Co., The:													
Robinson	42,400	43,500	15,700	[1]9,000 [4]6,500	[1]28,000	30.0	[4]8,000		[1]1,500	[2]1,500		250	
Pana Refining Co., Div. of Illinois Farm Supply Co.:													
Pana	5,000	5,000		[1]2,500			[1]650			[2]140			[1]1,050
Pure Oil Co., The:													
Lemont	48,000	(*)		[1]3,000 [3]6,000	[1]25,000	12.0			[2]1,600	[2]2,000			[1]5,500
Shell Oil Co.:													
Wood River	175,000	184,000	71,500	[3]21,000 [2]14,700 [2]16,300	[1]58,000	35.0	[1]38,000	[1]11,600	[1]9,500	[2]1,250	3,250	850	[1]3,700
Sinclair Refining Co.:													
Hartford	29,000	30,500	12,000	[1]6,000	[1]11,550 [4]6,000	5.0 0				[2]800			[1]1,500 [2]500
Socony Mobil Oil Co., Inc.:													
East St. Louis	38,000	40,000		[4]10,500	[2]33,000	30.0	[3]12,000		[2]2,580	[2]670		300	
Standard Oil Co. (Ind.):													
Wood River	50,000	53,500	6,000	[1]10,200 [2]3,400 [3]7,060 [2]3,740	[1]19,000	4.0	[4]9,000		[1]3,400	[2]123	1,073	126	[1]600 [2]700 [3]1,600
Texas Co., The:													
Lawrenceville	60,000	(*)	[1]20,000	[1][2]12,000	[1][2]30,000	([‡])	[1][2]13,500	[1][2]13,500	[1][2]2,000	[1][2]2,500			[1][2][3]2,200
Lockport	65,000	(*)	[1]13,500	[1][2]15,000 [1][4]9,500	[1][2]30,000	([‡])	[1][2]10,000	[1][2]10,000	[1][2]4,400	[1][2]600		[1][2]250	[1][2][3]3,000
Wireback Oil Co., The:													
Plymouth	1,200	1,200											
Total*	548,000	576,600	147,500	161,615	254,600		98,735	37,685	25,684	10,724	5,073	1,804	21,507

*State totals include crude capacities not reported, and calendar day figures converted to stream day. †Barrels per calendar day. ‡Not reported.

Indiana													
Allby Asphalt & Refining Co.:													
Hammond	7,500	8,000											[1]3,000 [2]4,500
Cities Service Oil Co. (Del.):													
East Chicago	53,000	53,000		[4]15,000	[1]30,000	28.0	[2]13,000		[1]2,560			440	
Indiana Farm Bureau Co-op. Association, Inc.:													
Mount Vernon	11,400	12,000	4,000	[2]4,000	[1]4,000	17.0	[1]3,000	[1]2,100		[2]300			
Jarvis Refining Co.:													
Troy	1,500	1,500											
R. J. Oil & Refining Co., Inc.:													
Princeton	4,000	4,500		[1]1,800			[1]750						
Rock Island Refining Corp.:													
Indianapolis	14,000	15,500	4,500	[2]6,000	[1]8,000	15.0	[1]2,400	[1]400		[2]500			

REFINERY SURVEY (INDIANA Continued)

Company and location	Crude capacity B.P.C.D.	Crude capacity B.P.S.D.	Charge, bbl. per stream day: Vacuum dist.	Thermal operations	Cat cracking: Total feed	Cat cracking: Per cent recycle	Catalytic reforming	Hydro. treating	Production, bbl. per stream day: Alkylation	Polymerization	Lubes	Coke (tons)	Asphalt
Sinclair Refining Co.:													
East Chicago	111,000	116,800	47,000	[1]12,000 [2]18,000	[1]45,000	20.0	[8]20,000		[1]650	[2]2,450	2,750		[1]4,000
Socony Mobil Oil Co., Inc.:													
East Chicago	36,000	38,000		[1]7,500	[2]18,000	10.0	[9]9,000		[1]3,200				
Standard Oil Co. (Ind.):													
Whiting	209,000	220,000	45,000	[1]42,000 [2]14,000 [3]15,300 [6]41,000	[1]60,000	0	[3]14,000 [5]14,000	[10]20,000	[1]5,000	[2]1,000	8,000	930	[1]2,900 [4]4,500 [3]2,500
Total	447,400	469,300	100,500	176,600	165,000	.....	76,150	22,500	11,410	4,250	10,750	1,370	21,400
Kansas													
Anderson-Prichard Oil Corp.													
Arkansas City	18,500	19,500	4,000	[1]3,500	[1]11,000	45.0	[1]5,000			[2]600			[1]1,000
Century Refining Co., Inc.:													
Shallow Water	6,000	6,000		[1]1,500	[6]2,000	0				[2]50			[1]500
Chanute Refining Co.:													
Chanute	1,500	1,500	1,500	[2]1,500									
Cooperative Refinery Association:													
Coffeyville	22,700	24,000	6,000	[6]8,000	*[1]9,000	(†)	[1]4,200	[3]3,000		[2]700	1,500	100	[1]1,000
Phillipsburg	9,500	10,000	5,000		*[1]4,250	(†)				[2]400			[1]1,800
Derby Refining Co.:													
Wichita	20,000	22,000	12,000	[1]3,000	[1]7,500	30.0	[2]2,500	[10]4,000		[2]1,200			[1]3,000 [2]500 [3]100
El Dorado Refining Co.:													
El Dorado	17,100	18,000	5,000		[1]13,000	50.0	[2]2,500			[2]1,200			[1]1,900 [2]300
Mid-America Refining Co., Inc.:													
Chanute	2,000	2,100		[1]1,200									
National Co-op. Refinery Association:													
McPherson	26,000	28,500	[1]11,000	[2]2,000 [6]11,000	[1]18,000	32.0	[1]5,500		[2]1,700	[2]1,000		250	
Phillips Petroleum Co.:													
Kansas City	57,000	(‡)	15,000		[1]40,000	40.0	[1]16,000			[2]1,700	2,400		[1]1,800
Skelly Oil Co.:													
El Dorado	42,000	45,000	12,000	[1]12,000	[1]22,500	12.0	[1]7,500			[2]1,400			[1]3,000
Socony Mobil Oil Co., Inc.:													
Augusta	35,000	37,000	13,200	[1]4,670	[2]23,000	35.0	[2]3,000		[2]1,450				[1]5,250 [2]1,000 [3]890
Standard Oil Co. (Ind.):													
Neodesha	22,500	22,500		[7]5,100	[1]10,000	18.0			[1]1,000			85	
Vickers Petroleum Co., Inc.:													
Potwin	17,000	18,000	8,500	[1]3,000 [2]1,000	[2]8,000	25.0				[2]1,500			
Total ¶	296,800	314,100	93,200	57,470	168,250	.....	46,200	7,000	4,150	9,750	3,900	435	22,040

*Fresh feed only. †Not reported. ‡Idle. ¶State totals include crude capacity not reported.

Kentucky													
Ashland Oil & Refining Co.:													
Catlettsburg	75,000	80,000	21,000	[1]6,000 [2]2,500	*[1]36,000	33.0	[6]6,500	[11]10,000	.....	[2]2,400	.....	.....	[5]5,000 [3]1,000
Louisville Refining Co., Inc.:													
Louisville	7,500	7,800	3,000	[2]2,500	[1]3,500	21.0	[1]2,000			[2]450			
Sohio Petroleum Co.:													
Covington	16,000	17,000	10,000	†[1]7,000 †[3]3,500						†[2]500			[2]3,500

REFINERY SURVEY (KENTUCKY Continued)

Company and location—	Crude capacity B.P.C.D:	Crude capacity B.P.S.D.	Charge, bbl. per stream day: Vacuum dist.	Thermal operations	Cat cracking: Total feed	Cat cracking: Per cent recycle	Catalytic reforming	Hydro. treating	Production, bbl. per stream day: Alkylation	Polymerization	Lubes	Coke (tons)	Asphalt
Somerset Refinery, The:													
Somerset	1,500	1,500			[6]400	0							
Total	100,000	106,300	34,000	21,500	39,900		8,500	10,000		3,350			9,500

*Replaced 25,000 bbl. T.C.C. unit. [1]In standby. Not currently operating.

Louisiana

American Oil Co. (formerly Pan-Am Southern Corp.):													
Destrahan	35,500	37,500	7,000	[5]10,500	[1]19,200	6.0	[2]3,200		[1]2,000			400	[1]5,500 [2]500
Atlas Processing Co.:													
Shreveport	*17,500	*19,000		[3]2,000			[1]7,160			[2]500			
Bayou State Oil Corp.:													
Hosston	785	1,200	565								470		[1]290
Bay Petroleum Corp., The:													
Chalmette	22,000	23,500	9,000		[1]11,000	28.0	[1]6,500			[2]800			
Breaux Bridge Oil & Refining Co., Inc.:													
Anse La Butte	1,600	1,600		[1]1,200									
Calumet Refining Co.:													
Princeton	850	950									800		[2]275
Canal Refining Co.:													
Church Point	1,200	1,200					[5]900						
Cities Service Refining Corp.:													
Lake Charles	185,000	(1)	26,000	[1]10,000 [2]12,000	[1]126,000	32.0	[2]18,000		[1]13,500				
Clark Oil & Refining Corp.:													
Marrero	6,500	7,000		[1]3,000						[2]125			
Continental Oil Co.:													
Westlake	52,000	55,000		[1]6,100 [2]2,600	[2]24,000	16.5	[1]5,900		[1]2,800	[1]670 [2]660			
Cotton Valley Solvents, Inc.:													
Cotton Valley	4,500	5,000											
Esso Standard Oil Co.:													
Baton Rouge	340,000	352,000	125,000	[1]41,000 [2]11,000	[1]156,000	20.0	[2]27,800		[1]14,000	[2]7,000	8,800		[1]9,800 [2]200
Evangeline Refining Co., Inc.:													
Jennings	2,000	2,500											
Ingram Oil & Refining Co.:													
Meraux	14,250	15,000	4,700		[1]7,000	35.0	[1]3,500			[2]325			
Shell Oil Co.:													
Norco	95,000	100,000	41,000	[3]9,500	[1]61,000	1.5			[1]7,400	[2]1,400			[1]950 [2]220 [3]330
Total[9]	778,685	816,180	213,265	97,900	404,200		72,960		39,700	11,480	10,070	400	18,035

*Natural gasoline and cycle product charged to stills. [9]State totals include calendar figures converted to stream day. [1]Alternate capacity. State total includes average capacity of 11,000 bbl. only.

Maryland

American Bitumuls & Asphalt Co.:													
Baltimore	4,500	7,500	7,500	*[2]6,000									[1]6,000 [2]400 [3]4,300
American Oil Co.:													
Baltimore	9,150	10,000											[1]5,500 [2]1,500
Esso Standard Oil Co.:													
Baltimore	69,800	75,000	12,400	[5]10,000	[1]60,500	35.6	[10]3,000	[2]17,000	[1]4,520			350	[1]5,000 [2]2,000
Total	83,450	92,500	19,900	16,000	60,500		3,000	17,000	4,520			350	24,700

*Atmospheric unit can be operated as visbreaker during winter months only for production of Bunker C fuel oil.

holds as much ammonia as

1,690 tank cars

You could discharge the loaded capacity of a train of tank cars over 12½ miles long into Phillips Chemical Company's huge aqua-ammonia storage tank at Cactus, Texas. With a diameter of 220 feet and a height of 48 feet, this new tank is the largest in the world used for liquid storage. Liquid is pumped in at a rate of about 250 gallons a minute . . . and yet it takes nearly 37 days to fill this 323,000-barrel-capacity tank.

Phillips' new tank was engineered, fabricated and site-erected by General American. General American has skilled crews and modern erection equipment strategically based throughout the country to facilitate the construction of both standard and custom-built storage structures.

If you are faced with the problem of storing liquids or gases, General American has the personnel, skill and experience to serve you. For information, call or write General American today.

It pays to plan with General American

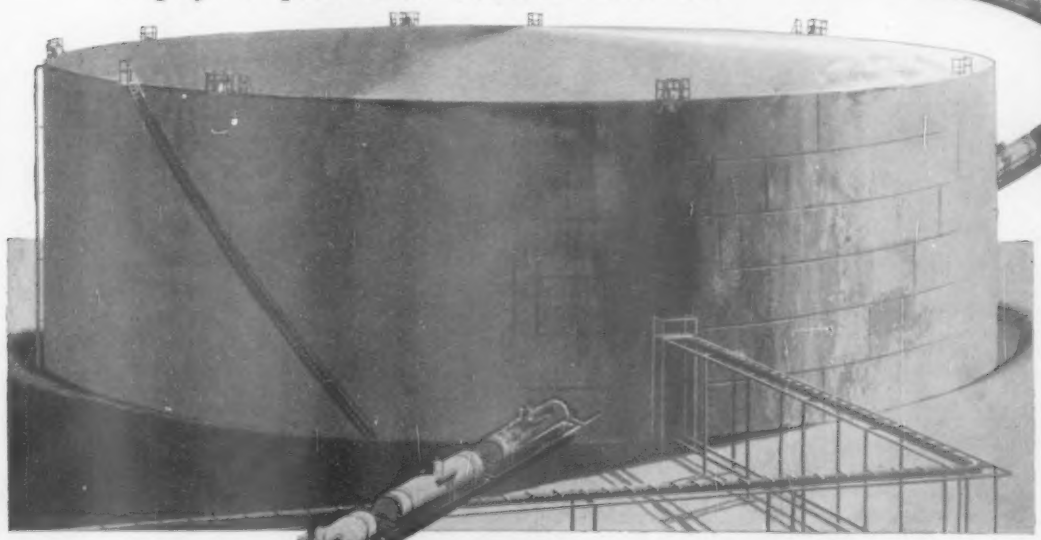
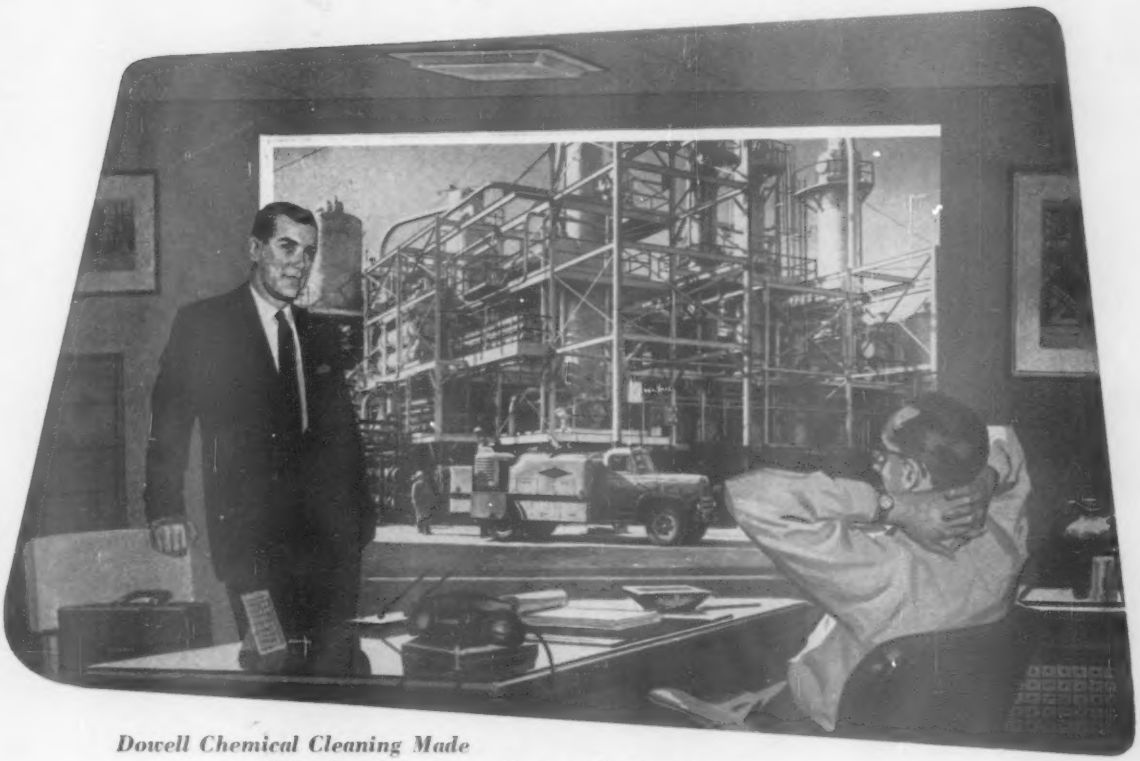


PLATE & WELDING DIVISION
GENERAL AMERICAN
TRADE MARK

PLATE & WELDING DIVISION
GENERAL AMERICAN TRANSPORTATION CORPORATION
135 South La Salle Street, Chicago 90, Illinois

Company and location—	Crude capacity— B.P.C.D.	Crude capacity— B.P.S.D.	Charge, bbl. per stream day: Vacuum dist.	Thermal operations	Cat cracking: Total feed	Cat cracking: Per cent recycle	Catalytic reforming	Hydro. treating	Production, bbl. per stream day: Alkylation	Polymerization	Lubes	Coke (tons)	Asphalt
Massachusetts													
Esso Standard Oil Co.:													
Everett	50,000	55,000	13,100	[2]10,000 [3]5,000	[1]24,500	35.0				[2]1,800			*[1]4,900 *[2]5,100
*Capacity when running for maximum production of oxidized asphalt.													
Michigan													
Aurora Gasoline Co.:													
Detroit	45,000	47,000	23,000	[2]8,000 [4]4,000	[1]19,000	15.8	[1]5,500	[1]10,000		[2]1,200		100	[1]3,500
Elsie	6,600	7,000					[1]1,500						
Muskegon	13,250	14,000		[2]4,000			[1]2,400	[1]1,500		[2]100			
Bay Refining Corp., Div. of Dow Chemical Co.:													
Bay City	10,000	10,500	2,000		[2]6,000	45.0				[2]300			
Crystal Refining Co.:													
Carson City	6,000	6,200											
Lakeside Refining Co.:													
Kalamazoo	3,200	3,200		[1]1,000	[2]750	0							
Leonard Refineries, Inc.:													
Alma, Leonard Division	9,500	10,500	5,000		[2]7,000	20.0	[2]2,500	[2]5,200 [1][2]2,500		[1]60			[1]2,250 [2]600
Alma, Mid-West Division	10,000	11,000		[1][2]3,500			[1]2,250			[1]100			
Mount Pleasant, Roosevelt Div.	7,500	7,700					[1]2,000	[1]500					
Marvel Refining Co.:													
Grand Rapids	1,100	2,000											
Naph-Sol Refining Co.:													
Muskegon	5,000	5,250		[1]2,500			[1]1,500						
Osceola Refining Co.:													
Reed City	1,500	1,500											
Petroleum Specialties, Inc.:													
Flat Rock	6,000	6,000		[1]800 [3]2,500			[1]1,500						
Socony Mobil Oil Co., Inc.:													
Trenton	29,500	31,000		[2]6,000	[2]23,000	35.0	[3]5,000			[2]900		200	
West Branch Refineries, Inc.:													
West Branch	5,000	5,000											[1]750
Total	159,150	167,850	30,000	32,300	55,750		28,150	19,700		2,660		300	7,100
Minnesota													
Great Northern Oil Co.:													
Pine Bend	28,500	30,000		[2]10,000	[2]25,000	50.0	[2]5,000	[1][2]6,000		[2]1,000		550	
International Refineries, Inc.:													
Wrenshall	11,000	12,000			[1]5,000	35.0				[2]270			
Northwestern Refining Co.:													
New Brighton	3,000	3,000	1,000										
St. Paul Park	12,000	12,000	5,000		[1]10,000	50.0				[2]1,200			
Total	54,500	57,000	6,000	10,000	40,000		5,000	16,000		2,470		550	
Mississippi													
Paluxy Asphalt Co.:													
Yazoo City	5,350	5,600	2,000	[1]2,000						[2]120			[2]1,800 [3]1,800
Southland Co., The:													
Sandersville	5,350	5,600	3,100										[1]2,250
Total	10,700	11,200	5,100	2,000						120			5,850

how would you like to add $250,000.00 to your profit?



Dowell Chemical Cleaning Made This Possible for an Industrial Plant!

In 1954 an East Coast plant employed Dowell Chemical Cleaning Service on a limited basis. The results were encouraging.

In 1955 the same company expanded its use of chemical cleaning. The results were startling. More throughput, less down time, and greater overall plant efficiency effected nearly a *$250,000.00 saving!*

In 1956 the program was continued. The result: still more savings. Eventually, chemical cleaning on a continuing year-around basis is expected to effect savings of from $300,000.00 to $500,000.00 annually.

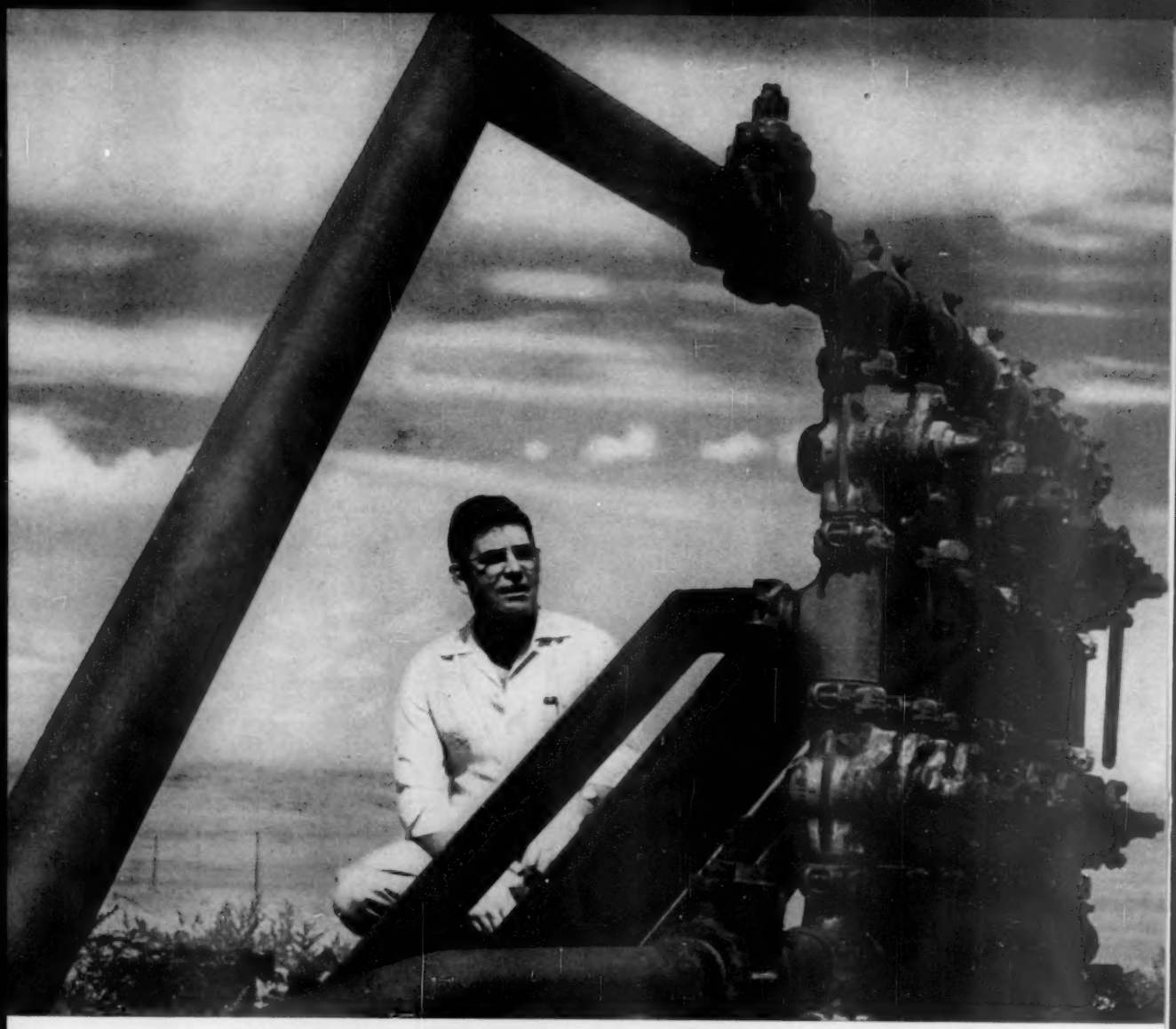
This case history is about an oil refinery. However, Dowell has eye-opening performance data to show you in almost any industry.

Dowell engineers are experts in the use of solvents to remove scales and sludges—those deposits that cut the capacity of process and steam generating systems. Dowell does the job for you and furnishes all necessary chemicals, trained personnel, pumping and control equipment.

For additional information, call the Dowell office near you. Or write Dowell Incorporated, Tulsa 1, Oklahoma.

clean it chemically DOWELL

A SUBSIDIARY OF THE DOW CHEMICAL COMPANY



Beth-Co-Weld is ideal pipe for gathering systems, such as this at Hamilton Dome Field, near Thermopolis, Wyo.

You Play It Safe with Beth-Co-Weld

Wherever there's need for pipe—whether for lease-gathering systems, gas-distribution systems, service lines on the rig, or general maintenance work—you play it safe when you use Beth-Co-Weld steel pipe.

Beth-Co-Weld is a quality pipe in every way. It's sound and long-lasting, and made from the most suitable grade of steel for the purpose. It was one of the first fully accepted types of continuous-weld line pipe.

You can get Beth-Co-Weld from the nearest Bethlehem Supply store. You'll save time, too, for chances are good that they can supply you from stock.

WITH BETH-CO-WELD YOU GET:

1. Pipe furnished to API Specification API 5-L. Also ASTM Specifications A-120 and A-53. Comes either coated, mill-wrapped, or uncoated for field-wrapping.
2. Black and galvanized pipe from ½ in. nominal to 4½ in. OD, in standard weights. Sizes from ½ in. through 3 in. nominal are also furnished in extra-strong weights.
3. Pipe in sizes 3½ in. and 4½ in. OD in weights lighter than standard.
4. Single mill lengths. Also double mill lengths up to 50 ft for sizes 1½ in. through 4½ in. OD.
5. Ends furnished in these styles: threaded-and-coupled; plain-end-beveled for welding; also plain-end-square-cut, grooved for ring-joint coupling.

BETHLEHEM SUPPLY COMPANY

General Offices: 21 E. Second St., Tulsa, Okla.
West Coast Headquarters: Los Angeles, Calif.
Export Distributor: Bethlehem Steel Export Corporation
25 Broadway, New York, N. Y.

BETHLEHEM STEEL

BETHLEHEM SUPPLY

REFINERY SURVEY

Company and location	Crude capacity B.P.C.D.	Crude capacity B.P.S.D.	Charge, bbl. per stream day: Vacuum dist.	Thermal operations	Cat cracking: Total feed	Cat cracking: Per cent recycle	Catalytic reforming	Hydro. treating	Production, bbl. per stream day: Alkylation	Polymerization	Lubes	Coke (tons)	Asphalt
Missouri													
Standard Oil Co. (Ind.):													
Sugar Creek	74,300	76,000	7,200	[1]19,600 [2]6,000 [3]24,900 [4]5,500	[1]32,000	0	[3]14,000	[1][2]20,000		[2]1,800		505	[1]1,000 [2]100 [3]2,700
Total	74,300	76,000	7,200	56,000	32,000	0	14,000	20,000		1,800		505	3,800
Montana													
Big West Oil Co. of Montana:													
Kevin	2,250	2,500	300	*[1]250 [2]1,200			[1]1,000			[2]12			[3]300
Carter Oil Co., The:													
Billings	24,000	27,000	10,000	[3]3,800	[1]25,000	50.0	[1][2]2,500	[2]6,900		[2]975		210	[1]5,000
Continental Oil Co.:													
Billings	9,250	10,500			[1]10,500	54.0				[2]450			
Diamond Asphalt Co.:													
Chinook	1,415	1,500	700										[1]700
Farmers Union Central Exch., Inc.:													
Laurel	19,000	20,000	9,000	[2]6,000	[1]11,000	1.3				[1]70 [2]630			[1]1,600
Jet Fuel Refinery:													
Mosby	600	600											
Phillips Petroleum Co.:													
Great Falls	2,700	(†)	1,600	[1]1,200						[2]30			[1]400
Texas Calgary Co.:													
Lodge Grass	1,125	1,425	475										[1]380
Texas Co., The:													
Sunburst	8,000	(†)		‡[1]5,000						‡[2]100			
Union Oil Co. of California:													
Cut Bank	3,800	4,200		[1]400 [2]2,300			[3]600	[1]900		[2]75			
Unity Petroleum Corp.:													
Kalispell	1,000	1,200											[1]500
Total†	73,140	80,187	22,275	20,700	46,500		4,100	7,800		2,353		210	8,880

*Idle. †State totals include crude capacity not reported, and calendar day figures converted to stream day. ‡Barrels per calendar day.

Nebraska													
Cooperative Refinery Association:													
Scottsbluff	2,100	2,200		[2]1,000			[1]650						
Searle Petroleum Co.:													
Salem	1,000	1,000											
Total	3,100	3,200		1,000			650						
New Jersey													
California Oil Co.:													
Perth Amboy	78,000	83,000		[2]5,000	[2]28,000	11.0	[1]13,000		[1]2,100	[2]300			[1]5,500
Cities Service Oil Co. (Pa.):													
Linden	14,300	15,000											[1]3,300 [2]2,500 [3]1,300
Esso Standard Oil Co.:													
Bayonne	25,000	26,500	15,000										[1]8,200 [2]2,600
Linden	168,000	175,000	73,800	[2]12,000 [3]15,000 **8,500	117,000	42.0		[2]30,000		[2]6,700			

REFINERY SURVEY (NEW JERSEY Continued)

Company and location	Crude capacity B.P.C.D.	Crude capacity B.P.S.D.	Charge, bbl. per stream day: Vacuum dist.	Thermal operations	Cat cracking: Total feed	Cat cracking: Per cent recycle	Catalytic reforming	Hydro. treating	Production, bbl. per stream day: Alkylation	Polymerization	Lubes	Coke (tons)	Asphalt
Socony Mobil Oil Co., Inc.:													
Paulsboro	80,000	84,200	41,000	.....	[2]35,000	25.0	[2]20,000	.....	[2]2,000	.....	8,300	.....	[2]1,200
Texas Co., The:													
Westville	66,000	(†)	‡25,000	‡[3]9,000	‡[1]35,000	(¶)	‡[1]12,000	‡[1]12,000 ‡[3]6,000	‡[1]1,600	‡[2]2,500	.....	.....	.....
Total†	431,300	453,200	156,100	50,490	218,850	.....	46,320	49,980	5,876	9,775	8,300	.....	24,400

[2]Available only at the expense of 6,500 bbl. per stream day of reforming capacity included above. †State totals include crude capacity not reported, and calendar day figures converted to stream day. [1]Barrels per calendar day. ¶Not reported.

New Mexico

Continental Oil Co.:													
Artesia	3,900	4,300	.....	[1]1,875	.....	.....	[4]1,500	.....	.....	.....	.....	.....	.....
Farmington	750	800	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
El Paso Natural Gas Products Co.:													
Bloomfield	2,500	2,500	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Brickland	4,000	4,500	.....	[1]2,000	.....	.....	[1]500	.....	.....	[1]30	.....	.....	.....
Prewitt	4,500	5,000	.....	[1]2,360	.....	.....	[1]750	.....	.....	[2]50	.....	.....	.....
Famariss Oil & Refining Co.:													
Monument	2,250	2,275	.....	.....	.....	.....	[1]700	[1]1,000	.....	.....	.....	.....	.....
Four States-Western Oil Refining Co.:													
Flora Vista	500	1,200	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Malco Refineries, Inc.:													
Artesia	11,500	12,000	2,500	.....	[2]6,000	23.0	.....	.....	.....	[2]400	.....	.....	[1]1,400
Total	29,900	32,575	2,500	6,235	6,000	.....	3,450	1,000	.....	480	.....	.....	1,400

New York

Frontier Oil Refining Co., Div. Ashland Oil & Refining Co.:													
North Tonawanda	28,500	30,000	12,000	.....	[1]15,000	30.0	.....	.....	.....	[2]900	.....	.....	[2]3,000
Gulf Oil Corp.:													
Staten Island	17,000	18,500	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Sinclair Refining Co.:													
Wellsville	8,000	8,400	3,000	[1]3,000 [3]5,000	.....	.....	.....	.....	.....	[2]100	2,500	.....	[1]300
Socony Mobil Oil Co., Inc.:													
Brooklyn	25,000	26,400	.....	.....	[2]23,000	55.0	.....	.....	.....	[2]1,200	.....	.....	.....
Buffalo	26,000	27,400	6,300	.....	[2]18,000	35.0	[2]9,000	.....	.....	[2]1,000	.....	.....	[1]330 [2]1,950
Total	104,500	110,700	21,300	8,000	56,000	.....	9,000	.....	.....	3,200	2,500	.....	5,580

North Dakota

Queen City Oil & Refining Co.:													
Dickinson	4,500	4,500	1,200	[1]750	[1]1,200	.....	.....	.....	.....	[1]100	.....	.....	.....
Standard Oil Co. (Ind.):													
Mandan	31,600	33,000	.....	.....	[1]23,000	48.0	[2]6,000	.....	.....	[2]4,365	.....	.....	.....
Westland Oil Co.:													
Williston	1,400	1,500	.....	.....	.....	.....	[1]200	.....	.....	.....	.....	.....	.....
Total	37,500	39,000	1,200	750	24,200	.....	6,200	.....	.....	4,465	.....	.....	.....

Ohio

American Bitumuls & Asphalt Co.:													
Cincinnati	5,500	10,000	10,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	[1]7,500
Ashland Oil & Refining Co.:													
Canton	29,450	31,000	.....	[2]11,000	[1]15,000	20.0	.....	.....	.....	[2]1,200	.....	.....	.....

Mr. Engineer: Cut Your Pump Inventory—Reduce Costs With These New, Proved Pumps

a new concept of economy through interchangeability of components!

New PEERLESS *type* DL & DM

PROCESS PUMPS ALSO FEATURE:

ACCESSIBILITY—Through ease of assembly and disassembly if and when required. **DURABILITY**—Through use of any machinable metal as materials of construction. **SERVICEABILITY**—Through designs that feature maximum ease of maintenance. **INTERCHANGEABILITY**—Through a choice of semi-open or enclosed impellers, oil or grease lubrication, air-or water-cooled back plates and bearing housings. **RELIABILITY**—Through the high performance standards set for these pumps, proving more than ever before, that Peerless Builds Dependable Pumps. **AVAILABILITY**—Through shipment from stock of both complete pumps and pump components.

Other pertinent Type DL-Type DM facts:

Peerless Type DL and Type DM process pumps are available in 1", 2", 2½" and 3" sizes on an 8½" frame and in 1", 2", 2½", 3" and 4" sizes on a 10½" frame. **CAPACITIES:** up to 800 gpm. **HEAD RANGE:** up to 430 feet. **DRIVES:** motor or steam turbine. **TEMPERATURE RANGE:** grease lubricated housing up to 250°F.; oil lubricated housing up to 450°F. **WORKING PRESSURES:** up to 400 psig.

Write for your New Bulletin now. Use coupon for quick action.

Here is

INTERCHANGEABILITY IN ACTION—

Interchangeability of component parts for DL-DM pumps is graphically shown in this Bulletin. Write for your copy. It shows how liquid end components are accommodated on either grease lubricated or oil lubricated bearing housings. Also provides quick reference to pump specifications and performance characteristics.

PEERLESS PUMP DIVISION
FOOD MACHINERY AND CHEMICAL CORPORATION
Factories: Indianapolis 8, Indiana and Los Angeles 31, California
Offices: New York, Indianapolis, Chicago, St. Louis, Atlanta, Lubbock and Plainview, Texas; Fresno, Los Angeles, Phoenix, Albuquerque.
Distributors in Principal Cities. Consult your local Telephone Directory.

PEERLESS PUMP DIVISION
Food Machinery and Chemical Corporation
301 West Avenue 26, Los Angeles 31, California

Please send chemical process pump Bulletin No. B-1608.

Name .....

Company .....

Address .....

City ..... State .....

OJG

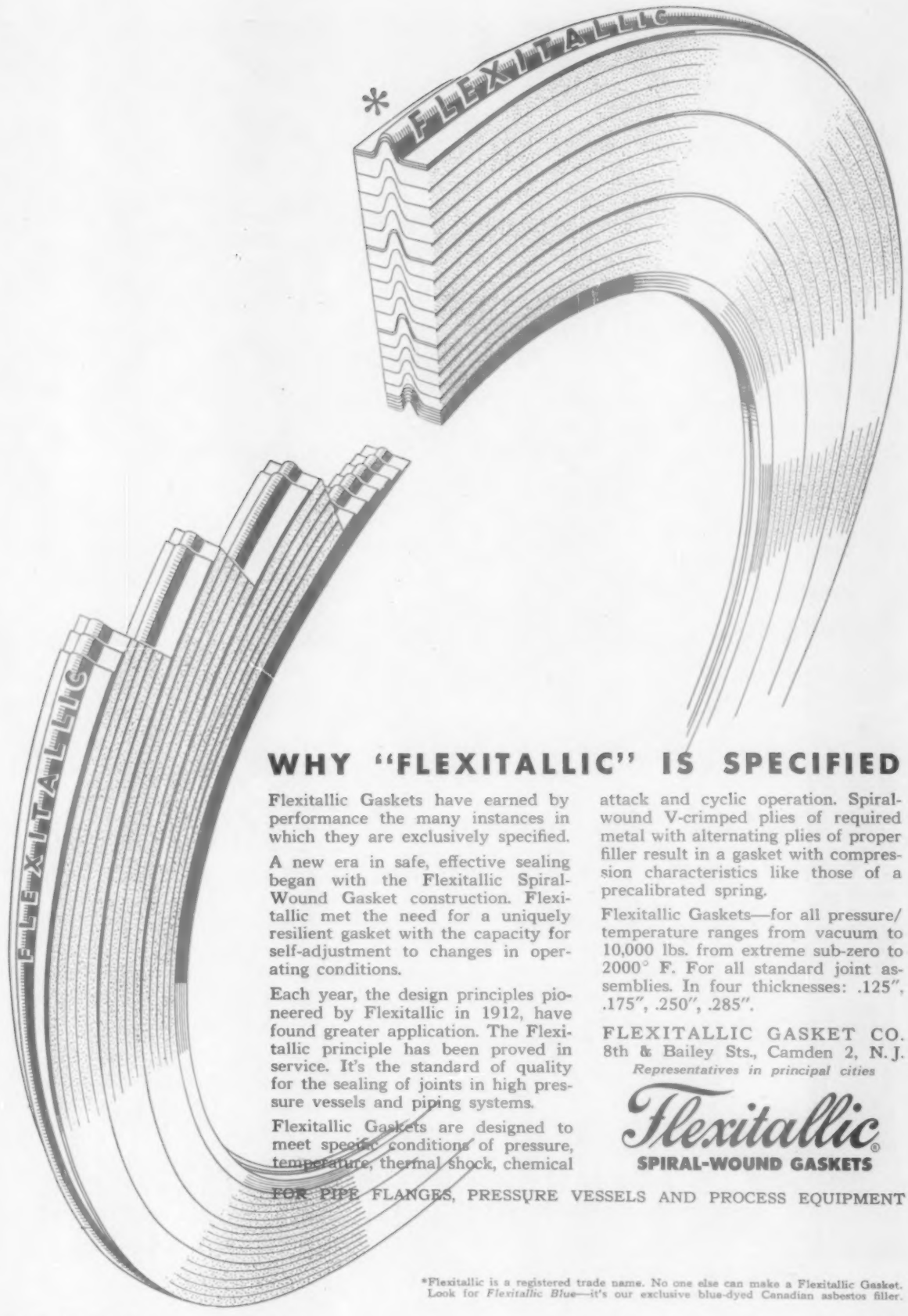
REFINERY SURVEY (OHIO Continued)

Company and location	Crude capacity B.P.C.D.	Crude capacity B.P.S.D.	Charge, bbl. per stream day: Vacuum dist.	Thermal operations	Cat cracking: Total feed	Cat cracking: Per cent recycle	Catalytic reforming	Hydro. treating	Production, bbl. per stream day: Alkylation	Polymerization	Lubes	Coke (tons)	Asphalt
Dewese Oil Refinery:													
Weston	1,500	1,500											
Gulf Oil Corp.:													
Cincinnati	32,000	35,000	11,400	[1]6,000	[1]19,000	30.0	[1]10,000			[2]1,500			[1]2,600
Toledo	42,000	44,000	8,000	[1]5,000	[1]19,000	21.0	[1]10,000			[2]1,500			
National Refining Co., Div. of Ashland Oil & Refining Co.:													
Findley	16,000	17,000	8,000	[1]5,500 [3]1,500						[2]250	1,000		[2]1,700
Pure Oil Co., The:													
Newark	17,500	(*)	6,100	[1]6,400	[1]4,500	0	[3]3,000	[1]3,000		[2]450			
Toledo	38,400	(*)	4,400	[1][2][3]6,500 [5]5,000	[1]11,600	35.5	[3]5,000			[2]1,270		175	
Standard Oil Co. (Ohio):													
Cleveland	52,000	55,000	18,000	[1]12,000	[2]28,000	25.0	[5]11,000	[10]11,000		[2]1,000	1,600		[2]7,000
Lima	47,000	50,000	11,000	[5]11,000	[1]37,000	20.0	[1]12,000	[1]13,000		[2]800	1,700	320	
Toledo	23,000	28,000		[1]8,000 [3]7,000 [5]7,000					[1]5,900	[2]700		180	
Sun Oil Co.:													
Toledo	95,000	(*)	(†)	‡[3]17,000	‡[3]62,000	(†)	‡[1]14,700		‡[1]1,400				
Total*	399,350	430,340	76,900	110,770	202,920		67,317	27,000	7,454	8,670	4,300	675	22,800

*State totals include crude capacities not reported, and calendar day figures converted to stream day. †Not reported. ‡Barrels per calendar day.

Oklahoma

Allied Materials Corp.:													
Stroud	3,000	3,100	1,600										[1]1,200 [2]1,000
Anderson-Prichard Oil Corp.:													
Cyril	11,000	11,500	5,000	[1]5,000			[5]1,000	[1]1,000		[2]250			[1]1,200 [2]500
Bell Oil & Gas Co.:													
Grandfield	8,000	(*)		[10]4,000			[1]1,800			[2]200			
Franklin, Ben, Refining Co.:													
Ardmore	13,000	13,300	6,500	[1]2,000 [3]3,000 [2]1,800	[1]7,000	40.0				[2]1,000			[1]1,300
Champlin Oil & Refining Co.:													
Enid	30,400	31,000	12,000	[1]4,000 [2][4]4,000	[1]15,000	33.0	[1]5,000			[2]1,000	1,500		
Cities Service Oil Co. (Del.):													
Ponca City	22,000	23,500	7,000	[1]800 [3]2,200 [2]1,950	[1]17,500	75.0						100	
Continental Oil Co.:													
Ponca City	58,000	62,000	10,800	[1]6,500 [4]4,000 [5]12,500	[2]33,500	43.0	[1]5,100		[1]5,000	[2]700	2,250	430	
D-X Sunray Oil Co.:													
Duncan	42,500	43,000	16,000	[5]11,000	[1]28,000	20.0	[1]6,000		[3]3,000	[2]750		400	
West Tulsa	74,000	75,000	24,000	[5]8,500	[1]35,000	18.0	[1]7,500		[1]2,300	[2]2,000	6,500	300	[2]1,000
Kerr-McGee Oil Industries, Inc.: (Formerly Deep Rock Oil Co)													
Cushing	20,000	21,500	3,500	[2]7,000	[1]10,500	29.0				[2]400	900		[1]400 [3]1,000
Wynnewood	15,600	16,500	4,800		[1]9,365	40.0				[2]400			[1][2]2,500
Mercury Oil Refining Co.:													
Oklahoma City	5,000	5,250		[1]1,400									
Midland Cooperatives, Inc.:													
Cushing	11,875	12,500		[2]5,500	[1]8,500	44.0	[1]2,580			[2]700			



WHY "FLEXITALLIC" IS SPECIFIED

Flexitallic Gaskets have earned by performance the many instances in which they are exclusively specified.

A new era in safe, effective sealing began with the Flexitallic Spiral-Wound Gasket construction. Flexitallic met the need for a uniquely resilient gasket with the capacity for self-adjustment to changes in operating conditions.

Each year, the design principles pioneered by Flexitallic in 1912, have found greater application. The Flexitallic principle has been proved in service. It's the standard of quality for the sealing of joints in high pressure vessels and piping systems.

Flexitallic Gaskets are designed to meet specific conditions of pressure, temperature, thermal shock, chemical attack and cyclic operation. Spiral-wound V-crimped plies of required metal with alternating plies of proper filler result in a gasket with compression characteristics like those of a precalibrated spring.

Flexitallic Gaskets—for all pressure/temperature ranges from vacuum to 10,000 lbs. from extreme sub-zero to 2000° F. For all standard joint assemblies. In four thicknesses: .125", .175", .250", .285".

FLEXITALLIC GASKET CO.
8th & Bailey Sts., Camden 2, N. J.
Representatives in principal cities

Flexitallic®
SPIRAL-WOUND GASKETS

FOR PIPE FLANGES, PRESSURE VESSELS AND PROCESS EQUIPMENT

*Flexitallic is a registered trade name. No one else can make a Flexitallic Gasket. Look for *Flexitallic Blue*—it's our exclusive blue-dyed Canadian asbestos filler.

REFINERY SURVEY (OKLAHOMA Continued)

Company and location	Crude capacity B.P.C.D.	Crude capacity B.P.S.D.	Charge, bbl. per stream day: Vacuum dist.	Thermal operations	Cat cracking: Total feed	Cat cracking: Per cent recycle	Catalytic reforming	Hydro. treating	Production, bbl. per stream day: Alkylation	Polymerization	Lubes	Coke (tons)	Asphalt
Phillips Petroleum Co.:													
Okmulgee	19,000	(*)	8,000	.....	[2]10,000	30.0	.....	.....	.....	[2]700	.....	.....	.....
Texas Co., The:													
West Tulsa	35,000	(*)	†12,000	†[1]9,000 †[3]5,000	†[1]15,000	(‡)	†[1]8,000	†[1]8,000	.....	†[2]1,500	.....	.....	.....
Total*	368,375	383,420	111,830	100,690	191,015	.....	37,860	9,880	10,300	9,765	11,150	1,230	10,100

*State totals include crude capacities not reported, and calendar day figures converted to stream day. †Barrels per calendar day. ‡Not reported.

Oregon

American Bitumuls & Asphalt Co.:													
Portland (Willbridge)	3,500	6,500	6,500	.....	.....	.....	.....	.....	.....	.....	.....	.....	[1]4,200 [2]900 [3]1,150

Pennsylvania

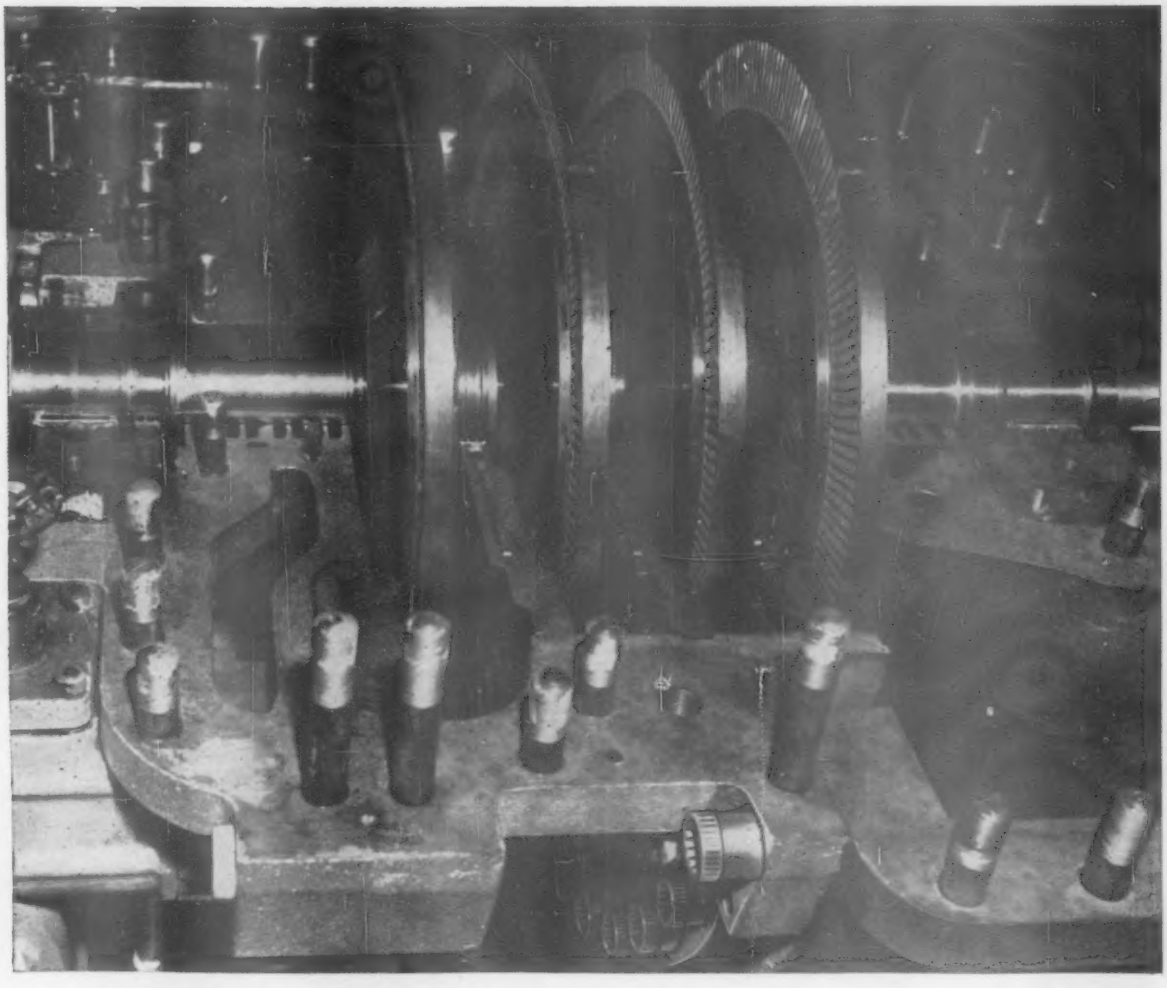
Atlantic Refining Co.:													
Philadelphia	148,000	156,000	45,000	.....	[1]63,000	40.0	*[1]3,000	.....	*[1]5,400	*[2]1,700	*5,000	.....	*[1]7,500 *[2]1,500
Franklin Refinery, Div. of L. Sonneborn Sons, Inc.:													
Franklin	2,000	2,000	.....	.....	.....	.....	.....	.....	.....	.....	500	.....	.....
Gulf Oil Corp.:													
Philadelphia	183,000	192,000	82,000	[2]24,000 [3]12,000	[1]90,000	32.0	[1]16,000	.....	[1]3,200	[2]3,500	925	.....	.....
Kendall Refining Co.:													
Bradford	4,800	5,200	.....	[1]1,400	.....	.....	[1]1,500	.....	.....	[2]100	1,200	30	.....
Pennsylvania Refining Co.:													
Karns City	1,500	1,500	600	.....	.....	.....	.....	.....	.....	.....	400	.....	.....
Pennzoil Co.:													
Rouseville	9,500	10,000	3,500	[1]1,600	[1]3,600	10.0	[1]2,900	[1]3,650	.....	[2]520	2,500	.....	.....
Quaker State Oil Refining Corp.:													
Emlenton	2,540	3,000	1,500	[1]750 [3]600	.....	.....	[1]1,000	.....	.....	[2]75	1,700	.....	.....
Farmers Valley	3,810	4,500	.....	[1]1,350	.....	.....	[1]1,500	.....	.....	[2]100	2,300	.....	.....
Sinclair Refining Co.:													
Marcus Hook	114,000	120,000	71,000	[1]5,000 [2]27,000	[1]45,000	20.0	[1]8,000	[1]10,000	.....	[2]1,850	.....	.....	.....
Sun Oil Co.:													
Marcus Hook	160,000	(†)	(‡)	*[3]24,000	*[2]20,000 *[3]26,000 *[4]30,000	(‡) (‡) (‡)	*[2]32,000	(‡)	*[2]7,000	.....	*11,800	.....	*[1]800
United Refining Co.:													
Warren	8,500	8,500	4,500	.....	.....	.....	[2]2,600	[1]750	.....	.....	1,000	.....	[1]500
Valvoline Oil Co., Div. of Ashland Oil & Refining Co.:													
Freedom	5,700	6,000	2,100	.....	.....	.....	.....	.....	.....	.....	1,250	.....	.....
Wolf's Head Oil Refining Co., Inc.:													
Reno	2,500	2,595	.....	.....	[1]920	0	.....	.....	.....	.....	750	.....	.....
Total†	645,850	680,195	210,200	100,340	286,880	.....	92,020	14,400	16,964	8,032	31,173	30	11,378

*Barrels per calendar day. †State totals include crude capacities not reported, and calendar day figures converted to stream day. ‡Not reported.

Rhode Island

Texas Co., The:													
Providence	3,500	(*)	†1,750	.....	.....	.....	.....	.....	.....	.....	.....	.....	†[1-2-3]1,500
Total*	3,500	3,680	1,840	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,665

*State totals include crude capacity not reported, and calendar figures converted to stream day. †Barrels per calendar day.



THE *INSIDE STORY* OF A MURRAY HIGH SPEED COMPRESSOR DRIVE TURBINE REVEALS THE REASONS FOR MURRAY'S UNIVERSAL ACCEPTANCE

A look at MURRAY'S rugged construction from the inside shows the husky shaft and heavy accurately formed discs with generous sized hubs designed to withstand the axial and radial stresses imposed by this type of service.

Large-dimension disc rims receive the specially contoured stainless steel blades with the Murray integral shroud. This insures smooth steam passages with maximum strength.

Short bearing spans insure smooth operation and eliminate the hazard of operating in critical speeds.

A look at the heavy flanges and husky bolting in the actual unretouched shop photo shown above bears out the extreme ruggedness that typifies every feature of Murray construction.

Our nearest representative will gladly help you solve your high speed compressor drive turbine requirements. Just write to Murray Iron Works Company, Burlington, Iowa for his name.

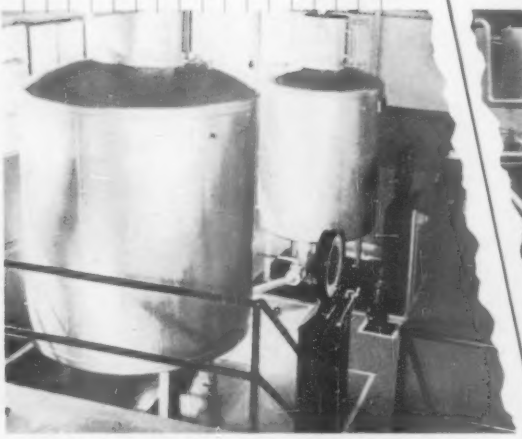
★★ **Murray Turbines** ★★

REFINERY SURVEY

Company and location	Crude capacity B.P.C.D.	Crude capacity B.P.S.D.	Charge, bbl. per stream day: Vacuum dist.	Thermal operations	Cat cracking: Total feed	Cat cracking: Per cent recycle	Catalytic reforming	Hydro. treating	Production, bbl. per stream day: Alkylation	Polymerization	Lubes	Coke (tons)	Asphalt
South Carolina													
Esso Standard Oil Co.:													
Charleston	8,000	8,700	6,800										[1]4,100 [2]400
Tennessee													
Delta Refining Co.:													
Memphis	5,700	6,000	1,240		[2]3,000	20.0				[2]250			
Southern Oil Service:													
Nashville	400	800											
Total	6,100	6,800	1,240		3,000					250			
Texas													
American Liberty Oil Co.:													
Mount Pleasant	28,500	30,000	12,000	[2]2,000	[2]10,000	40.0				[2]400			[1] [2]7,200
American Oil Co.:													
Texas City	148,000	160,000	27,000	[1]28,000 [2]25,500 [3]10,500	68,000	2.0	[5]21,000	[10]23,000	[1]9,000	[2]3,000			[1]5,000
Atlantic Refining Co.:													
Port Arthur	62,000	65,000	19,000		[1]31,000	30.0	[6]7,800			[8]2150			
Bryson Pipeline & Refining Co.:													
Bryson	2,000	2,000									500		
Cactus Petroleum Co., Inc. (formerly McBride Refining Co.):													
Brownsville	7,500	7,500	5,000										[1]3,500
La Blanca	3,500	3,500					[6]1,000						
Col-Tex Refining Co.:													
Colorado City	9,500	10,000	6,000				[1]1,800	[1]1,800		[2]100			[1]2,700
Continental Oil Co.:													
Wichita Falls	8,000	9,000		[1]4,100 [3]1,350						[1]550 [2]200			
Corpus Christi Refining Co.:													
Corpus Christi	8,075	8,500	2,000										
Cosden Petroleum Corp.:													
Big Spring	28,600	30,100	14,500	[1]7,500	[1]14,100	7.0	[1]4,500 [11]4,000	[1]2,100	[2]3,700	[2]420			[1]3,500 [2]350 [3]1,000
Hawley, Onyx Div. (formerly Onyx Refining Co.)	6,500	7,200	1,000	[1] [2]3,500			[1]700			[2]150			
Crown Central Petroleum Corp.:													
Houston	35,150	37,000		[1] [2]8,500	[2]16,000	25.0	[5]5,500	[5]5,500					
Danaho Refining Co.:													
Pettus	4,500	4,500		[1]1,000			[1]1,000			[2]50			
Delhi-Taylor Oil Corp.:													
Corpus Christi	40,000	42,000		[2]2,400	[2]12,000	25.0	[1]5,000			[2]500			
Delhi-Taylor Oil Corp. & Mayfair Minerals, Inc.:													
Port Isabel	15,000	15,500					[1]5,000						
Eastern States Petroleum Co., Inc.:													
Houston	63,000	65,000	26,000	[2]20,000	[1]19,500	12.0	[1]7,900	[1]22,500	[1]4,500				
Eddy Refining Co.:													
Houston	2,000	2,000											
Flint Chemical Co.:													
San Antonio	230	230											
Gladewater Refining Co.:													
Gladewater	2,500	2,500		[1]1,500			[1]700			[2]90			
Gratex Corp. (formerly G & B Oil Co.):													
Graham	700	700											
Gulf Oil Corp.:													
Port Arthur	282,000	300,000	121,000	[2]23,500 [2]23,000	[1]125,000 [2]25,000	27.0 0	[2]29,000	[5]50,000	[4]4,300	[3]3,600	14,300		

EXCEL-SO METER CALIBRATING TANKS

SELECTED FOR THE ROCKWELL TEST STATION AT PITTSBURGH



Rockwell's indoor proving room is equipped with EXCEL-SO Calibrating Tanks for controlled metering.

EXCEL-SO Calibrating Tank in service at world's largest meter and valve testing installation—Rockwell Test Station.

In world wide service this famous EXCEL-SO product has proven itself as a scientific measuring instrument—not just an ordinary welded tank. It is designed and fabricated to meet the most exacting requirements—meter testing under laboratory conditions. In stationary, portable and high pressure service it insures greatest metering accuracy for petroleum products. Write Warner Lewis Company for further information.

WARNER LEWIS COMPANY

BOX 3096 • TULSA, OKLAHOMA

DIVISION OF FRAM CORPORATION

Representatives in all major cities. In Canada: FRAM CANADA, LTD., Stratford, Ontario

REFINERY SURVEY (TEXAS Continued)

Company and location—	Crude capacity— B.P.C.D.	Crude capacity— B.P.S.D.	Charge, bbl. per stream day: Vacuum dist.	Thermal operations	Cat cracking: Total feed	Cat cracking: Per cent recycle	Catalytic reforming	Hydro. treating	Production, bbl. per stream day: Alkylation	Polymerization	Lubes	Coke (tons)	Asphalt
Howell Refining Co.:													
San Antonio	3,000	3,200											
Humble Oil & Refining Co.:													
Baytown	282,000	310,700	(†)	[1]16,500 [2]22,500	[1]102,500	0	[5]40,000	[2]71,700	[1]10,700	[2]4,200	17,300		[1 2 3]2,900
Magnolia Petroleum Co.:													
Beaumont	200,000	225,000	49,000	[2]45,000 [3]14,000	[2]89,400	15.0	[7]16,000 [9]19,300		[1]5,400	[1]1,700	6,400		
Matagorda Corp.:													
Bay City	1,850	1,850											
McMurrey Refining Co.:													
Tyler	22,500	25,000		[1]4,500 [6]10,000	[1]10,000	15.0	[1]5,500		[1]2,200	[2]700		100	
Monarch Refining Co.:													
San Antonio	2,500	2,500											
Panhandle Oil Corp.:													
Wichita Falls	8,400	9,000		[2]2,000	[2]2,500	20.0				[2]150			
Phillips Petroleum Co.:													
Phillips	71,000	(‡)	17,000	[1]8,000 [2]28,000 [3]8,000	[1]40,000 [6]11,000	5.0 0	[1]16,000	[11]10,000	[2]7,100	[2]750			
Sweeney	95,000	(‡)	17,000		[1]30,000	20.0	[1]16,000		[2]5,000				
Phoenix Refining Co.:													
San Antonio	3,500	3,500											
Pontiac Refining Corp.:													
Corpus Christi	44,600	47,000	7,000		[1]6,300	23.0	[1]12,000			[2]600			
Premier Oil Refining Co.:													
Baird	2,350	2,500		[1]1,200									
Fort Worth	7,900	8,000	1,700	[2]2,200	[1]5,700	47.0	[1]1,700			[2]290			
Longview	4,000	4,200		[1]2,200						[1]75			
Pure Oil Co., The:													
Nederland	78,900	(‡)	20,000	[1]10,500	[1]17,750 [2]9,800	27.0 48.5	[5]15,000	[10]20,000	[1]2,925	[2]825	2,000		
Rado Refining Co.:													
McAllen	1,500	1,500											
Republic Oil Refining Co.:													
Texas City	42,700	45,000	20,000		[1]20,000	15.0	[1]7,200			[2]2,000			
Shamrock Oil & Gas Corp.:													
Sunray	20,000	21,000	8,000	[1]3,000	[3]13,500	26.0	[1]2,500	[1]5,300	[1]2,400				[1]925
Shell Oil Co.:													
Houston	125,000	132,000	42,000	[3]15,000 [9]32,500	[1]39,000	4.0	[1]32,500	[1 3]17,000	[1]4,900		3,800		[1]530
Sinclair Refining Co.:													
Corpus Christi	29,000	30,500		[1]7,000 [3]3,000	[4]15,000	20.0			[2]1,700				
Houston	138,000	145,300	43,000	[1]10,000 [2]14,000	[1]50,000 [2]11,000	20.0 9.0	[2]26,000		[1]2,400		4,250		
Skelly Oil Co.:													
Longview	4,500	5,000		[1]3,300			[1]1,800			[2]100			
Southwestern Oil & Refining Co.:													
Corpus Christi	47,500	50,000	8,000		[1]9,250	11.50	[1]10,000						[1]3,000
Standard Oil Co. of Texas:													
El Paso	38,000	41,000	11,400	[1]9,000	[3]15,000	30.0	[1]5,500		[1]1,600				
Suntide Refining Co.:													
Corpus Christi	75,000	76,000	16,000		[1]30,000	30.0			[2]3,000	[2]1,500			
Texas Asphalt & Refining Co.:													
Pasadena	2,000	7,500											[1]4,000
Texas-Calgary Co.:													
Carrizo Springs	2,000	2,000											
Texas City Refining, Inc.:													
Texas City	34,000	35,000		[2]5,000	[3]15,000	0			[2]2,500				
Texas Co., The:													
Amarillo	15,000	(‡)		[*]2,000 [*6]3,500	[*]8,000	(†)	[*]4,500	[*]4,500	[*]800	[*2]200		[*]100	

REFINERY SURVEY (TEXAS Continued)

Company and location	Crude capacity B.P.C.D.	Crude capacity B.P.S.D.	Charge, bbl. per stream day: Vacuum dist.	Thermal operations	Cat cracking: Total feed	Cat cracking: Per cent recycle	Catalytic reforming	Hydro. treating	Production, bbl. per stream day: Alkylation	Polymerization	Lubes	Coke (tons)	Asphalt
El Paso	13,000	(‡)	.....	*12,000 *3,500	*17,000	(†)	*13,500	*13,500	.....	*2500	.....	*100	.....
Port Arthur	230,000	(‡)	*60,000	*109,000 *17,500 *7,000	*160,000	(†)	*140,000	*140,000	*12,000	*21,800	*16,000	*200	.....
Port Neches	40,000	(‡)	*22,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	[1] [2] 6,000
Texas Gas Corp.:													
Winnie	§5,000	§5,000	.....	.....	.....	.....	2,500	.....	.....	.....	.....	.....	.....
Three Rivers Refinery:													
Three Rivers	1,500	1,500	500	.....	.....	.....	.....	.....	.....	.....	750	.....	2150
Tydal Co., The:													
Gainesville	2,000	2,000	.....	.....	.....	.....	.....	.....	.....	.....	200	.....	.....
Wickett Refining Co.:													
Wickett	3,500	3,500	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Total‡	2,453,955	2,619,980	580,400	599,145	946,550	.....	377,680	282,180	87,533	24,892	67,260	544	41,415

*Barrels per calendar day. †Not reported. ‡State totals include crude capacities not reported, and calendar day figures converted to stream day. §Charge stock comprises natural gasoline and cycle product.

Utah

Company and location	Crude capacity B.P.C.D.	Crude capacity B.P.S.D.	Charge, bbl. per stream day: Vacuum dist.	Thermal operations	Cat cracking: Total feed	Cat cracking: Per cent recycle	Catalytic reforming	Hydro. treating	Production, bbl. per stream day: Alkylation	Polymerization	Lubes	Coke (tons)	Asphalt
Phillips Petroleum Co.:													
Woods Cross	12,500	(*)	3,000	.....	210,000	45.0	.....	.....	.....	2400	.....	.....	11,100
Salt Lake Refining Co.:													
Salt Lake City	38,000	40,000	25,000	.....	18,000 313,000	50.0 25.0	.....	.....	.....	.....	.....	.....	.....
Sure-Seal Corp.:													
Woods Cross	665	700	700	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Uinta Oil Refining Co.:													
Jensen	1,200	1,200	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Utah Oil Refining Co.:													
Salt Lake City	29,400	30,000	.....	17,200	116,500	0	55,500	.....	13,500	2800	120	.....	11,800
Western States Refining Co.:													
North Salt Lake	3,500	3,500	.....	11,500 22,000	.....	.....	41,000	.....	.....	.....	.....	.....	.....
Total*	85,265	88,560	28,700	10,700	47,500	.....	6,500	.....	3,500	1,200	120	.....	2,900

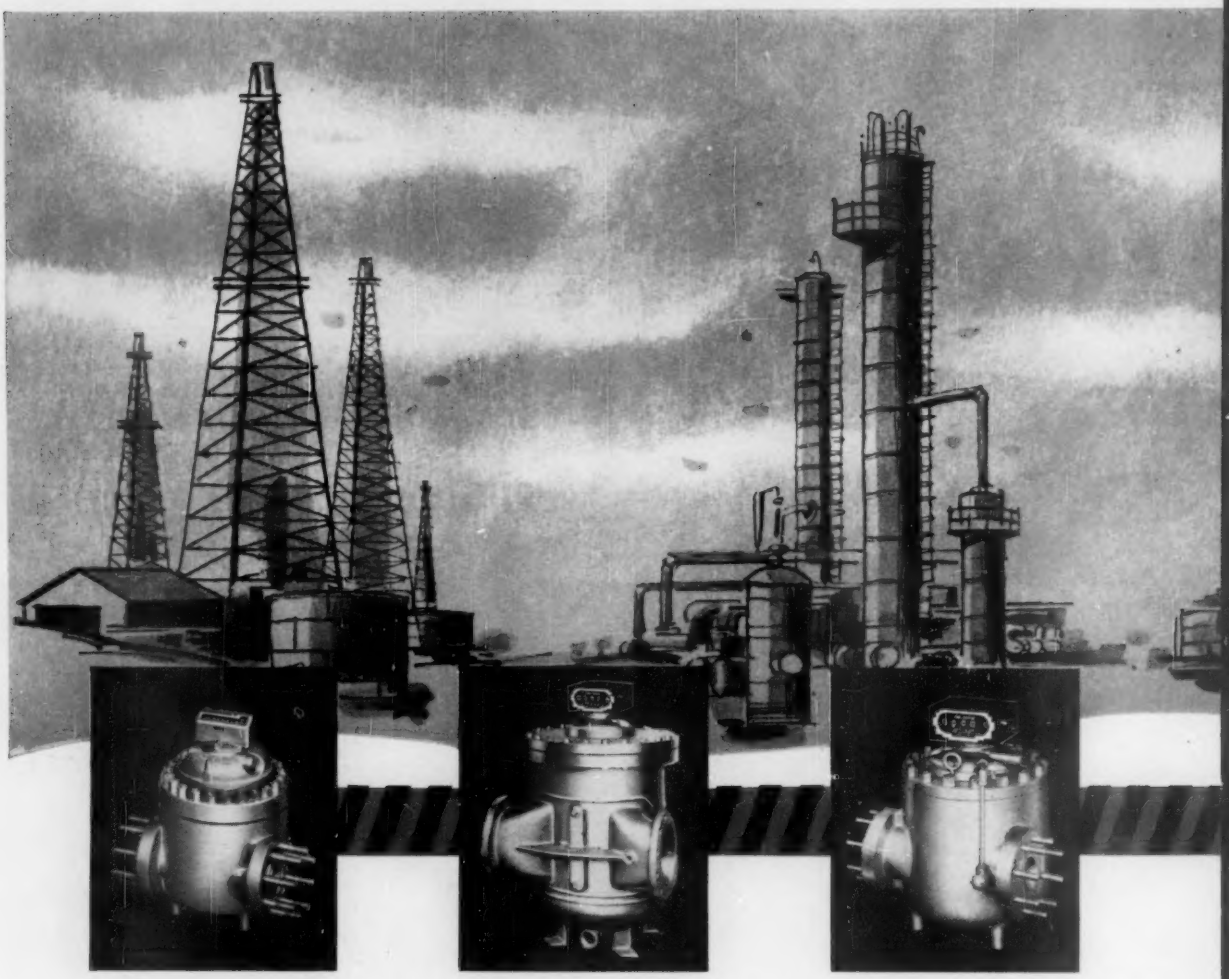
*State totals include calendar day figures converted to stream day.

Virginia

Company and location	Crude capacity B.P.C.D.	Crude capacity B.P.S.D.	Charge, bbl. per stream day: Vacuum dist.	Thermal operations	Cat cracking: Total feed	Cat cracking: Per cent recycle	Catalytic reforming	Hydro. treating	Production, bbl. per stream day: Alkylation	Polymerization	Lubes	Coke (tons)	Asphalt
American Oil Co.:													
Yorktown	34,100	35,000	19,000	69,600	130,600	30.0	.....	.....	.....	32,500	.....	600	.....

Washington

Company and location	Crude capacity B.P.C.D.	Crude capacity B.P.S.D.	Charge, bbl. per stream day: Vacuum dist.	Thermal operations	Cat cracking: Total feed	Cat cracking: Per cent recycle	Catalytic reforming	Hydro. treating	Production, bbl. per stream day: Alkylation	Polymerization	Lubes	Coke (tons)	Asphalt
American Bitumuls & Asphalt Co.:													
Richmond Beach	1,000	3,500	3,500	.....	.....	.....	.....	.....	.....	.....	.....	.....	12,600 21,500
General Petroleum Corp.:													
Ferndale	35,000	37,000	10,000	26,600	220,000	40.0	96,000	.....	.....	21,000	.....	.....	.....
Shell Oil Co.:													
Anacortes	50,000	53,000	20,000	.....	123,000	0	18,500	138,400	.....	24,000	.....	.....	.....
Union Oil Co. of California:													
Edmonds	4,000	5,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	13,500 2600
Total	90,000	98,500	33,500	6,600	43,000	.....	14,500	8,400	.....	5,000	.....	.....	8,200



High pressure meter Model M-12. M Series meters for working pressures up to 1200 psi.

Line meters. Model B-200, shown, has capacity range 400 to 2000 gpm.

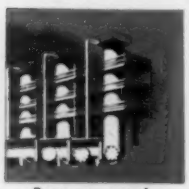
High pressure meter Model D-35. D Series meters for working pressures up to 600 psi.

A MILLION BARRELS OF CRUDE THERE'S AN A. O. SMITH METER

STANDARDIZING on A. O. Smith meters and gasoline dispensers is the most dependable safeguard against loss in your production, processing, delivery and dispensing.

All along the line — from wellsite to service station — you can rely on A. O. Smith meters to give you sustained, uninterrupted measuring accuracy for greater efficiency, highest flow rates. And with simplified hook-up design, fewer fittings are needed — you save time and money on installation.

If you aren't using A. O. Smith products now, it will pay you to get in touch with your nearest representative or write direct.

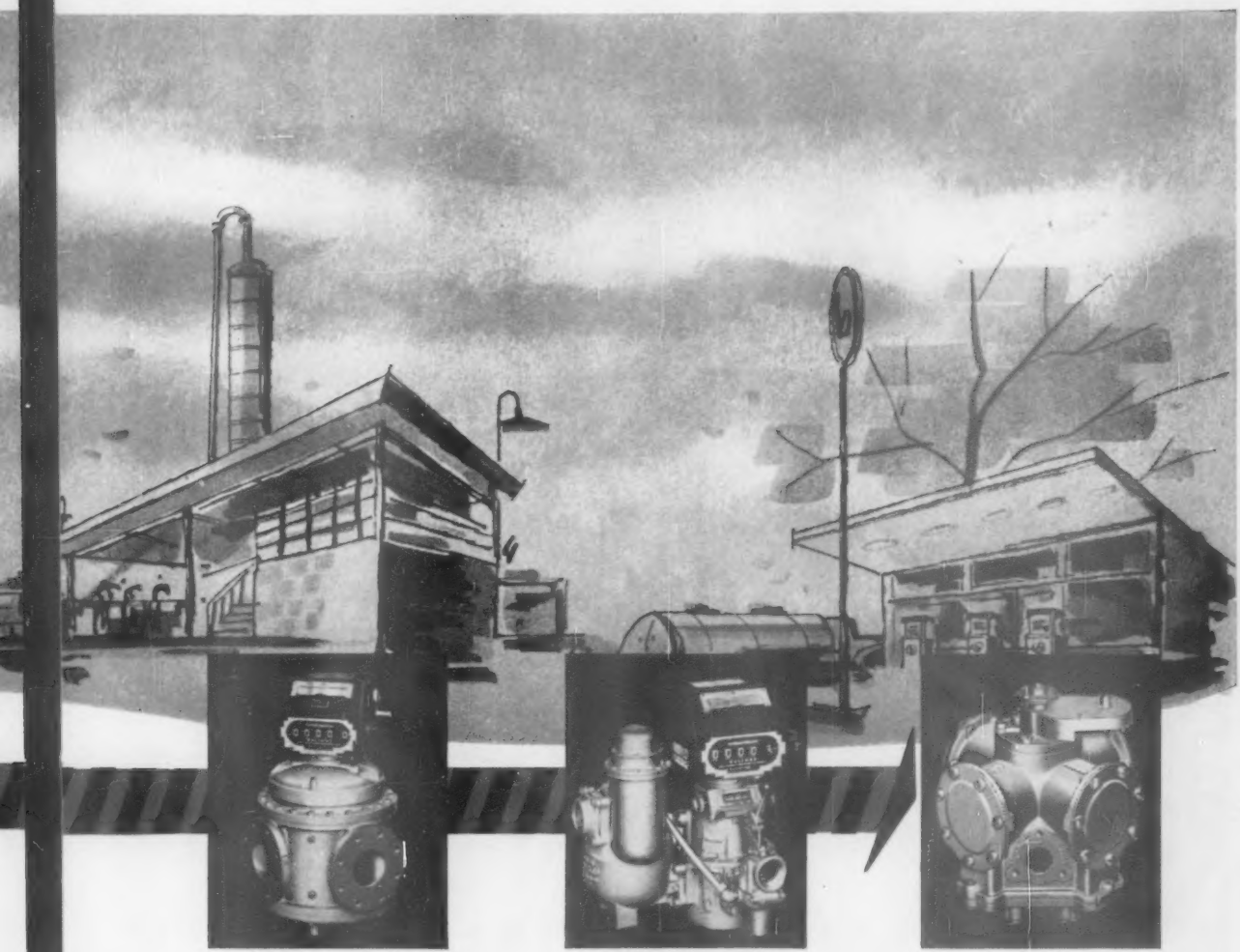


Pressure vessels, heat exchangers

Welding machines, electrodes, accessories

Glascote processing equipment

Line pipe, oil well casing

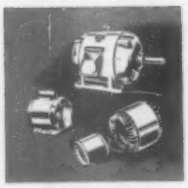


Line meters. Model AS-50, shown, has capacity range 90 to 500 gpm.

Truck and industrial meters. Model T-10, shown with air eliminator, has capacity range 20 to 100 gpm.

Dispenser pump meter, Model PM-2. Exceptionally accurate, doubly guaranteed.

OR A DOLLAR'S WORTH OF PREMIUM TO ACCOUNT FOR EVERY DROP



Electric motors

Through research A.O. Smith *... a better way*

A.O.Smith
CORPORATION

MILWAUKEE 1, WISCONSIN

12 plants in New Jersey, Pennsylvania, Ohio, Wisconsin, Illinois, Texas and California

International Division; Milwaukee 1, Wisconsin

Company and location	Crude capacity B.P.C.D.	Crude capacity B.P.S.D.	Charge, bbl. per stream day: Vacuum dist.	Thermal operations	Cat cracking: Total feed	Cat cracking: Per cent recycle	Catalytic reforming	Hydro. treating	Production, bbl. per stream day: Alkylation	Polymerization	Lubes	Coke (tons)	Asphalt
West Virginia													
Elk Refining Co.:													
Falling Rock	4,300	4,500	1,500	[1]1,500	.....	.....	[1]1,500	[1]500	.....	[2]100	1,200	.....	.....
Quaker State Oil Refining Corp.:													
St. Marys	2,371	2,800	.....	[1]750 [3]600	.....	.....	[1]1,000	.....	.....	[2]75	600	.....	.....
Total	6,671	7,300	1,500	2,850	.....	.....	2,500	500	.....	175	1,800	.....	.....
Wisconsin													
Empire Petroleum Co.:													
Sheboygan	7,500	8,400	3,400	.....	.....	.....	.....	.....	.....	.....	.....	.....	[1]2,500
Lake Superior Refining Co.:													
Superior	6,000	6,500	1,800	[1]1,500	.....	.....	[1]1,000	.....	.....	.....	.....	.....	[1]1,080
Total	13,500	14,900	5,200	1,500	.....	.....	1,000	.....	.....	.....	.....	.....	3,580
Wyoming													
Big Horn Refining Co.:													
Lovell	5,500	6,000	.....	.....	[6]830	10.0	.....	.....	.....	.....	.....	.....	[1]2,800
C & H Refinery:													
Lusk	200	200	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Crook County Refinery:													
Sundance	125	125	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Empire State Oil Co.:													
Thermopolis	5,000	5,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Frontier Refining Co., The:													
Cheyenne	18,240	19,200	3,250	[10]4,500	[1]9,000	10.0	[1]2,500	[1]3,500	.....	[2]800	.....	.....	[1]1,400
Husky Oil Co.:													
Cody	6,500	7,000	.....	.....	.....	.....	[6]1,050	[9]1,000	.....	.....	.....	.....	[1]2,500 [2]500 [3]500
Sinclair Refining Co.:													
Sinclair	24,000	25,300	9,000	[1]2,000 [3]2,000	[1]12,500	20.0	.....	.....	[1]1,700	[2]350	.....	.....	[1]750
Sioux Oil Co.:													
Newcastle	3,000	3,100	.....	[1]1,500	.....	.....	[4]750	.....	.....	[2]50	.....	.....	.....
Socony Mobil Oil Co., Inc.:													
Casper	11,500	12,200	.....	[1]1,350	[7]7,800	50.0	.....	.....	.....	[2]450	.....	.....	[1]1,500
Standard Oil Co. (Ind.):													
Casper	18,800	21,000	7,000	[1]4,450 [7]2,500	[1]8,750	3.9	[5]3,750	.....	[1]800	.....	650	118	[1]700 [2]50 [3]2,000
Texas Co., The:													
Casper	17,000	(*)	†9,000	†[6]4,000	†[1]6,000	(‡)	†[1]4,000	†[1]4,000	.....	†[2]500	.....	†100	†[1 2 3]1,400
Total*	109,665	117,015	28,720	22,740	45,540	.....	12,490	8,940	2,500	2,205	650	229	14,254

*State totals include calendar day figures converted to stream day. †Barrels per calendar day. ‡Not reported.

Puerto Rico													
Caribbean Refining Co.:													
Bayamon	12,825	13,500	9,000	.....	[1]13,100	43.0	.....	.....	.....	[2]500	.....	.....	.....
Commonwealth Oil Refining Co., Inc.:													
Guayanilla	21,770	23,520	13,800	.....	[3]26,800	50.0	[4]3,730	.....	[1]1,460	[2]900	.....	.....	.....
Total	34,595	37,020	22,800	.....	39,900	.....	3,730	.....	1,460	1,400	.....	.....	.....

REPORT ON CANADIAN OPERATING REFINERIES

Location and Capacities as of January 1, 1957

Province	No. plants	Crude capacity B.P.C.D.	Crude capacity B.P.S.D.	Charge, bbl. per stream day: Vacuum dist.	Thermal operations	Catalytic cracking total feed	Catalytic reforming	Hydro-treating	Production, bbl. per stream day: Alkylation	Polymerization	Lubes	Coke (tons)	Asphalt* (1)	Asphalt* (2)	Asphalt* (1-2-3)
Alberta	11	80,250	87,310	18,950	29,200	23,300	6,475	3,575	850	560	2,000	120	6,800	1,450	920
British Columbia	5	68,750	72,500	27,900	4,800	29,800	7,050	3,300		4,140			6,000		630
Manitoba	4	30,700	33,100	11,960	1,375	14,890	1,000			507					220
New Brunswick	1	300	300												
Northwest Territories	1	1,300	1,500												
Nova Scotia	1	42,000	46,500	23,300	10,900	27,800				4,900					940
Ontario	6	157,850	172,050	50,400	29,200	78,410	11,130	650		1,960	4,420	24	2,200	500	2,200
Quebec	5	242,900	260,390	93,200	43,500	121,500	35,200	10,500	1,400	9,030	330	75	5,000	2,000	3,600
Saskatchewan	9	67,600	73,600	30,550	20,350	41,500	650	1,000		1,610		100	5,200	500	210
Total	43	691,650	750,410	256,260	139,325	337,200	61,505	19,025	2,250	22,707	6,750	319	25,200	4,450	8,720

*Asphalt is reported thus: (1) straightrun; (2) oxidized; (1-2-3) combined straightrun, oxidized, and other.

Company and location	Crude capacity B.P.C.D.	Crude capacity B.P.S.D.	Charge, bbl. per stream day: Vacuum dist.	Thermal operations	Cat cracking: Total feed	Cat cracking: Per cent recycle	Catalytic reforming	Hydro. treating	Production, bbl. per stream day: Alkylation	Polymerization	Lubes	Coke (tons)	Asphalt
Alberta													
Anglo-American Exploration, Ltd.:													
Hartell	3,600	4,000		[1-2-3]1,500			[6]1,000			[2]60			
Bonnyville Oil Refining:													
Bonnyville	1,000	1,000											
British American Oil Co., Ltd.:													
Calgary	6,500	7,200	2,500	[1]2,500			[6]2,000						[1]600
Edmonton	6,300	7,000		[1]1,400 [6]2,100	[4]4,000	50.0						60	
Excelsior Refineries, Ltd.:													
Lloydminster	3,550	4,000	2,350										[1]2,000 [2]500
Husky Oil & Refining, Ltd.:													
Lloydminister	7,900	8,500	2,100				[4]400						[1]3,300 [2]950
Imperial Oil, Ltd.:													
Calgary	9,200	10,300		[1]5,400					[1]850				[1-2-3]920
Edmonton	25,000	26,500	10,200	[1]10,100	[1]12,800	33.0	[6]2,200	[2]2,700			2,000		
McColl-Frontenac Oil Co., Ltd.:													
Edmonton	11,700	(*)		[1]3,000 [6]2,200	[1]6,500	30.0				[2]500		60	
North Star Oil, Ltd.:													
Grand Prairie	2,100	2,500		[1]1,000			[5]875	[4]875					
Wainwright Producers & Refining, Ltd.:													
Wainwright	3,400	3,500	1,800										[1]900
Total*	80,250	87,310	18,950	29,200	23,300		6,475	3,575	850	560	2,000	120	9,170

*Province totals include crude capacities not reported.

REFINERY SURVEY

Company and location	Crude capacity B.P.C.D.	Crude capacity B.P.S.D.	Charge, bbl. per stream day: Vacuum dist.	Thermal operations	Cat cracking: Total feed	Cat cracking: Per cent recycle	Catalytic reforming	Hydro. treating	Production, bbl. per stream day: Alkylation	Polymerization	Lubes	Coke (tons)	Asphalt
British Columbia													
Imperial Oil, Ltd.:													
Ioco	25,000	26,500	10,400		[1]11,800	31.0				[2]2,490			[1-2-3]630
Royalite Oil Co., Ltd.:													
Kamloops	4,750	5,000	2,000		[1]3,500	60.0				[2]250			[1]500
Shell Oil Co. of Canada, Ltd.:													
Vancouver (Shellburn plant)	19,000	20,000	8,000	[2]3,500	[1]5,000	25.0	[1]3,300	[1]3,300		[2]1,000			[1]3,000
Standard Oil Co. of B. C., Ltd.:													
N. Burnaby	17,000	18,000	7,500		[1]9,500	40.0	[1]2,750			[2]400			[1]2,500
X-L Refineries, Ltd.:													
Dawson Creek	3,000	3,000		[1]1,300			[4]1,000						
Total	68,750	72,500	27,900	4,800	29,800		7,050	3,300		4,140			6,630
Manitoba													
Anglo-Canadian Oils, Ltd.:													
Brandon	2,700	3,100		[1]1,375			[1]1,000			[2]50			
Imperial Oil, Ltd.:													
Winnipeg	15,000	16,000	7,100		[1]6,400	23.0							[1-2-3]220
North Star Oil, Ltd.:													
St. Boniface	11,000	12,000	4,860		[1]8,490	45.0				[2]457			
Radio Oil Refineries, Ltd.:													
East Kildonan	2,000	2,000											
Total	30,700	33,100	11,960	1,375	14,890		1,000			507			220
New Brunswick													
New Brunswick Oilfields, Ltd.:													
Weldon	300	300											
Northwest Territories													
Imperial Oil, Ltd.:													
Norman Wells	1,300	1,500											
Nova Scotia													
Imperial Oil, Ltd.:													
Halifax	42,000	46,500	23,300	[2]10,900	[1]27,800	46.0				[2]4,900			[1-2-3]940
Ontario													
British American Oil Co., Ltd.:													
Clarkson	19,400	21,500	6,000	[5]4,500	[1]17,400	33.0				[2]1,260	1,220		[1]1,500 [2]500
Canadian Oil Companies, Ltd.:													
Corunna	27,400	30,000	15,000	[2]3,000	[1]22,000	40.0	[1]4,500			[2]700			
Husky Oil & Refining, Ltd.:													
Fort William	3,450	3,750	1,400				[4]1,000						[1]700
Imperial Oil, Ltd.:													
Sarnia	80,000	87,000	28,000	[1]4,400 [2]4,400 [3]8,900	[1]26,800	20.0		[2]650			3,200	24	[1-2-3]2,200
Regent Refining (Canada), Ltd.:													
Port Credit	12,600	14,000		[10]4,000			[1]2,300						
Sun Oil Co., Ltd.:													
Sarnia	15,000	(*)	(†)		[‡]11,000	(†)	[‡]3,000						
Total*	157,850	172,050	50,400	29,200	78,410		11,130	650		1,960	4,420	24	4,900

*Province totals include crude capacities not reported, and calendar day figures converted to stream day. †Not reported. ‡Barrels per calendar day.

Photograph courtesy of The Lummus Company

SUNTIDE REFINING COMPANY—now only three years old—is taking long steps to strengthen its position in the refining industry. The Suntide refinery at Corpus Christi, Texas, planned for 26,300 b/d when it went on stream in 1954, already has a capacity exceeding 50,000 b/d.

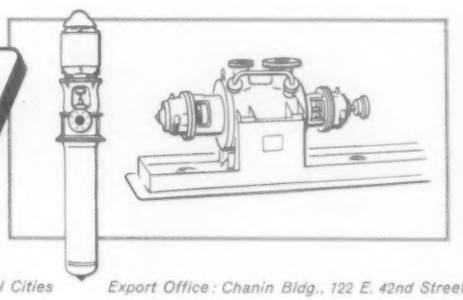
New refinery units now being added will result in both higher octane and greater capacity to meet the ever-increasing demand for Suntide products.

...PACIFIC PUMPS INC. was selected to supply practically 100% of Suntide's centrifugal pump requirements for the original refinery.

PACIFIC was selected again to furnish virtually all of the centrifugal pumping units required in Suntide's present expansion program ... convincing evidence of Suntide's satisfaction in the quality and performance of PACIFIC centrifugal pumps.

PACIFIC®

PACIFIC PUMPS INC.
HUNTINGTON PARK, CALIFORNIA



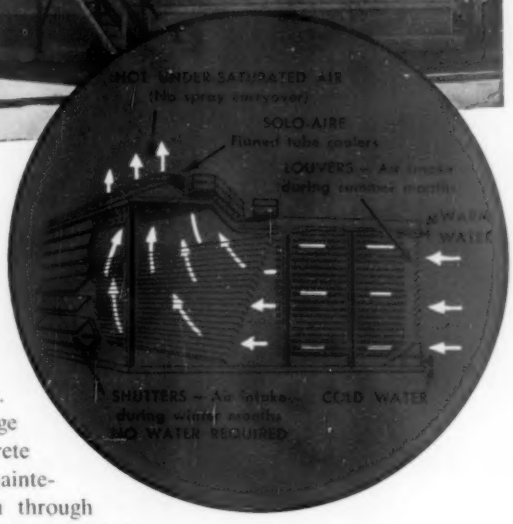
Offices in all Principal Cities

Export Office: Chanin Bldg., 122 E. 42nd Street, New York, N. Y.

CP-16

HUDSON Combin-aire

LOW TEMPERATURE COOLING USING COMBINATION OF MINIMUM WATER AND MAXIMUM AIR



Where quantity or quality of water is low, and ambient air temperatures too high to permit direct cooling with air, process plant designers find the modern solution in Combin-aire. In addition to large savings through minimizing water consumption and eliminating water treatment, Combin-aires incorporate many other advantages.

The Combin-aire pictured above, installed in a large gas processing plant in northern Mexico, is of concrete construction, eliminating fire hazard and minimizing maintenance. As shown in the cut-away drawing, air is drawn through cooled water by fans located on top of the structure. The air, precooled and washed free of solids by the water, flows across the finned tube coolers, and leaves the top of the Combin-aire at elevated temperature under-saturated with water vapor. Mist carryover, condensation from effluent air, and air recirculation are thus eliminated. Combin-aires are installed adjacent to process equipment, minimizing piping and concentrating operating area.

In winter, air flows directly to the Solo-aire finned coolers, water circulation being unnecessary. Where water is required for shell and tube units or atmospheric sections, such water may also be cooled in the Combin-aire unit, eliminating the conventional cooling tower.

In addition to Combin-aire units, Hudson manufactures water cooling towers, air-cooled and water-cooled coolers and condensers, and is experienced in plant layout, piping, and water treatment. We shall be glad to assist prospective plant owners in making overall comparisons of first costs and operating costs for complete cooling systems using various combinations of equipment.

HUDSON
ENGINEERING CORPORATION

FAIRVIEW STATION • HOUSTON, TEXAS

405 Lexington Ave., New York 17, N. Y. • 2500 W. Sixth St., Los Angeles 57, Calif. • Corrientes 1115, Buenos Aires, Argentina

REFINERY SURVEY

Company and location	Crude capacity B.P.C.D.	Crude capacity B.P.S.D.	Charge, bbl. per stream day: Vacuum dist.	Charge, bbl. per stream day: Thermal operations	Charge, bbl. per stream day: Cat cracking: Total feed	Charge, bbl. per stream day: Cat cracking: Per cent recycle	Charge, bbl. per stream day: Catalytic reforming	Charge, bbl. per stream day: Hydro. treating	Production, bbl. per stream day: Alkylation	Production, bbl. per stream day: Polymerization	Production, bbl. per stream day: Lubes	Production, bbl. per stream day: Coke (tons)	Production, bbl. per stream day: Asphalt
Quebec													
British American Oil Co., Ltd.:													
Montreal	40,500	45,000	12,000		[1]22,000	18.0	[6]13,000			[2]630	330		[1]5,000 [2]2,000
Canadian Petrofina, Ltd.:													
Montreal	20,000	21,500	9,700	[5]3,800	[3]17,000	38.0	[5]3,600	[5]3,000	[1]1,400	[3]300		75	
Imperial Oil, Ltd.:													
Montreal East	69,000	76,000	38,500	[2]12,000 [4]4,700	[1]28,000	29.0				[5]5,400			[1-2-3]3,600
McColl-Frontenac Oil Co., Ltd.:													
Montreal East	55,000	(*)		[2]14,000	[1]30,000	20.0	[1]12,000			[2]1,500			
Shell Oil Co. of Canada, Ltd.:													
Montreal East	58,400	60,000	33,000	[2]9,000	[1]24,500	25.0	[1]6,600	[5]7,500		[2]1,200			
Total*	242,900	260,390	93,200	43,500	121,500		35,200	10,500	1,400	9,030	330	75	10,600
Saskatchewan													
British American Oil Co., Ltd.:													
Moose Jaw	13,500	15,000	5,500	[1]1,500 [6]2,250	[1]10,000	55.0				[2]390		100	[1]1,200
Consumers Co-op. Refineries, Ltd.:													
Regina	15,500	16,000	6,500	[2]3,000	[1]10,000	50.0				[2]500			
Husky Oil & Refining, Ltd.:													
Moose Jaw	2,950	3,200	1,400	[2]1,400			[6]650	[1]1,000					[1]900 [2]250
Imperial Oil, Ltd.:													
Regina	22,500	25,000	10,500	[1]5,000 [3]3,400	[1]15,000	40.0				[2]320			[1-2-3]210
Northern Petroleum Corp., Ltd.:													
Kamsack	800	800											
Petroleum Fuels, Ltd.:													
Moose Jaw	1,100	1,100											
Prince Albert Refineries, Ltd.:													
Prince Albert	900	1,000											[1]300
Royalite Hi-Way, Ltd.:													
Saskatoon	5,850	6,500	2,800	[2]3,800	[1]6,500	60.0				[2]400			[1]300
Royalite Oil Co., Ltd.:													
Coleville	4,500	5,000	3,850										[1]2,500 [2]250
Total	67,600	73,600	30,550	20,350	41,500		650	1,000		1,610		100	5,910

Operating Plants Making Petroleum Products, But Not Charging Whole Crude

Asphalt

Byerlite Corp. Heath, Ohio 2,000 bbl. per day of straightrun; 5,200 bbl. per day of oxidized

Envoy Petroleum Co. Long Beach, California 1,100 bbl. per day of straightrun and oxidized

Fiberboard Paper Products Corp. Emeryville, Calif. 3,000 bbl. per day of oxidized

Portland, Ore., 525 bbl. per day of oxidized

Lunday-Thagard Oil Co. South Gate, Calif. 1,700 bbl. per day of oxidized

Monarch Refineries, Inc. Oklahoma City 1,000 bbl. per day of oxidized

Socony Mobil Oil Co., Inc. East Providence, R. I. 560 bbl. per day of straightrun; 3,900 bbl. per day of oxidized

Lubes and Waxes

Cit-Con Oil Corp. Lake Charles, Louisiana 9,000 bbl. per day of lubes

Dallawax Co. Kilgore, Tex. 500 bbl. per day of wax from tank bottoms

Petrolite Corp., Ltd. Kilgore, Tex. 700 bbl. per day of wax from tank bottoms

Ultra-Penn Refining Co. Bruin, Penn. 100 bbl. per day of lubes

Other

Calstate Refining Co. Long Beach, Calif. 2,500 bbl. per day visbreaking; 1,100 bbl. per day Hyperforming

Kerr-McGee Oil Industries, Inc. (formerly Johnson Oil Ref. Co.) Cleveland, Okla., 1,800 bbl. per day Platforming

31 States, 7 Provinces, 1 Territory Share in Refining Industry's Expansion

A

Advance Refining Co., Inc., will increase crude capacity by 3,000 bbl. per day at Centralia, Ill., by September 1, 1957.

Alaska-Yukon Refiners & Distributors, Ltd. will complete a 7,500-bbl. per day refinery at Haines, Alaska, in 1958. It will include a 2,500-bbl. per day thermal cracking unit. Plant will cost $6,000,000.

American Gilsonite Co. will complete by summer of 1957, a $5,000,000 plant near Grand Junction, Colo. Foster Wheeler Corp. has contract for 4,000-bbl. per day delayed coker; H. K. Ferguson & Co. has a 1,750-bbl. per day catalytic reformer which is being engineered by California Research Corp.; Kaiser Engineers has a coke calciner to produce 250 tons per day.

American Oil Co. is increasing Ultraforming capacity 6,120 bbl. per day, and adding a 12,500-bbl. per day Standard Oil Co. (Ind.) hydrodesulfurization unit at El Dorado, Ark. (formerly Pan-Am Southern Corp.'s plant). Lummus Co. is contractor, and completion is set for January 1, 1958.

At Texas City, Tex., Ultraforming capacity will be increased 21,000 bbl. per day, and hydrofining (Ind.) capacity 22,000 bbl. per day by February 1958. Ralph M. Parsons Co. has contract.

At Yorktown, Va., a 7,600-bbl. per day Ultraformer and a 22,600-bbl. per day hydrodesulfurization (Indiana Standard) unit will be completed in 1957 by Ralph M. Parsons Co., contractor. In 1958, crude capacity will be increased 25,000 bbl. per day, capacity of vacuum unit charging topped crude will be increased 16,400 bbl. per day, and a 12,000-bbl. per day straightrun asphalt unit will be completed. M. W. Kellogg is primary contractor.

Anderson-Prichard Oil Corp. will increase crude capacity 6,500 bbl. per day, and straightrun asphalt capacity 250 bbl. per day at Arkansas City, Kans., by June 1, 1957. Blaw-Knox has contract for asphalt expansion.

At Cyril, Okla., crude capacity will be increased 2,000 bbl. per day. An 11,000-bbl. per day fluid catalytic cracker with 45 per cent recycle, and a 600-bbl. per day hydrofluroic acid alkylation unit will be added. Completion is set for April 1, 1957.

B

British American Oil Co., Ltd., is adding a 4,000-bbl. per day catformer at Edmonton, Alta. Lummus Co. is contractor.

At Clarkson, Ont., a 10,000-bbl. per day Catformer and a 12,000-bbl. per day hydrodesulfurization unit will be completed early 1957, by Lummus Co. Crude capacity will be increased 40,000 bbl. per day and capacity of vacuum unit charging topped crude will be increased 22,200 bbl. per day by late 1957, by M. W. Kellogg.

At Montreal, Que., Lummus Co. will complete a 15,500-bbl. per day hydrodesulfurization unit early 1957.

British Petroleum, Ltd., has purchased a 600-acre site at Ville d'Anjou near Montreal, Que., for a planned 30,000-bbl. per day refinery to cost over $30,000,000.

C

California Oil Co. will increase crude capacity 10,600 bbl. per day at Perth Amboy, N. J., by April 1, 1958.

Calumet Refining Co. will increase crude capacity 2,200 bbl. per day at Princeton, La., by June 1, 1957.

Canadian Oil Companies, Ltd. will increase Platforming capacity 4,400 bbl. per day, and add a 3,650-bbl. per day Udex unit at Corunna, Ont., by August 1957. Fluor Corp. has contract. Engineering and design are by U.O.P.

Champlin Oil & Refining Co. will complete a 1,500-bbl. per day hydrofluoric acid alkylation unit at Enid, Okla., by March 1958.

Chemoil Corp. will complete a new refinery between New Orleans and Baton Rouge, La., by December 1958. It will have a crude capacity of 22,000 bbl. per day, a 10,000-bbl. per day vacuum unit charging topped crude, a 14,000-bbl. per day gas-oil cracking unit, a 5,000-bbl. per day naphtha-reforming unit, a 9,000-bbl. per day delayed coker, a 3,000-bbl. per day hydrofluoric acid alkylation unit, a 1,000-bbl. per day catalytic polymerization unit, and coke production of 350 tons per day. The plant will include a catalytic cracking unit, a catalytic reforming unit, and a hydrogenation unit.

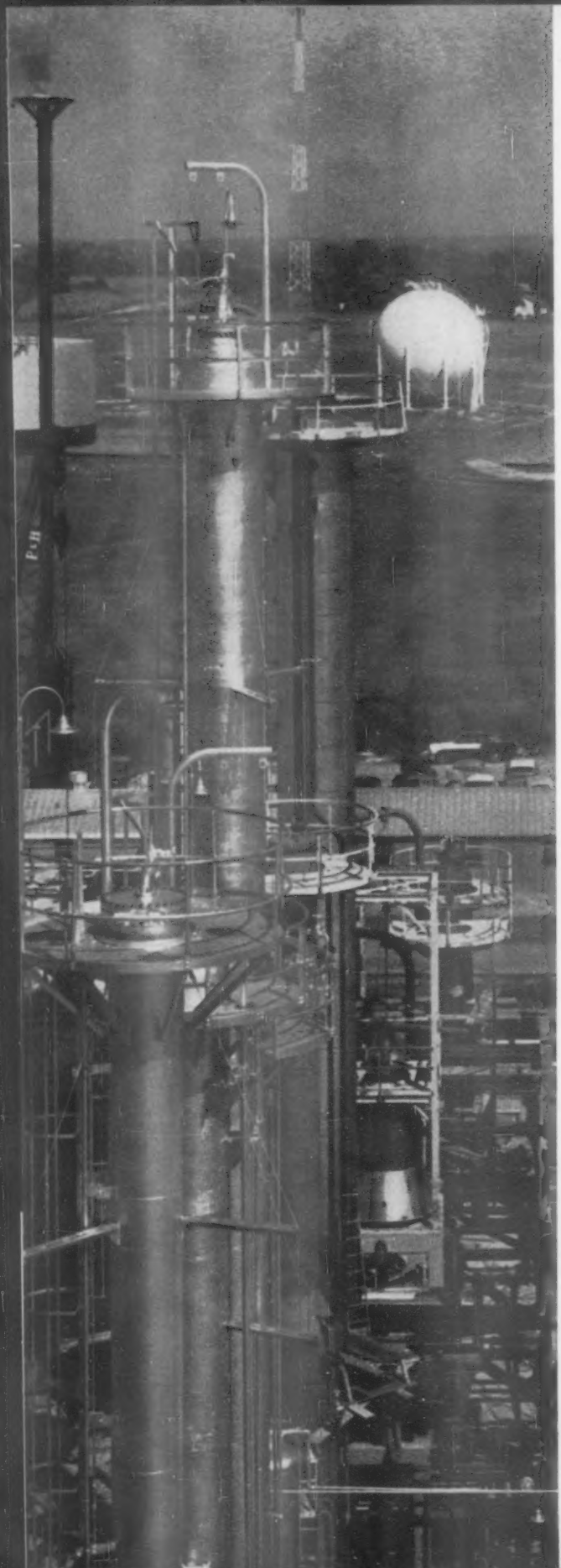
Cities Service Co. will build a $22,000,000 refinery at Toronto, Ont. Design will allow ready expansion from an initial 20,000-bbl. per day capacity. Plant will include two-stage atmospheric and vacuum distillation, fluid catalytic cracking, catalytic reforming, and hydrodesulfurization. C. F. Braun Co. of Canada, Ltd., is engineering contractor for the job. Completion is set for November 1957.

Cities Service Oil Co. (Del.) will have completed a 6,000-bbl. per day U.O.P. Rexformer at Ponca City, Okla., by February 1, 1957. By May 1, 1957, crude capacity will be increased 11,500 bbl. per day, capacity of vacuum unit for charging topped crude increased 3,500 bbl. per day, and fluid catalytic cracking increased 500 bbl. per day with 28 per cent recycle.

Cities Service Refining Corp. will increase crude capacity 15,000 bbl. per day at Lake Charles, La., by June 1958. In 1957, fluid catalytic cracking capacity will be increased by 19,000 bbl. per day by June, and alkylation capacity will be increased 1,000 bbl. per day by September.

Clark Oil & Refining Corp. will increase crude capacity by 7,000 bbl. per day at Blue Island, Ill., by January 1, 1958. Capacity of vacuum unit charging topped crude will be increased 8,000 bbl. per day by September 1, 1957. By March 1, 1958, a 15,000-bbl. per day fluid catalytic cracking unit and a 1,500-bbl. per day sulfuric acid alkylation unit will be completed.

Commerce Oil Refining Co. is building a 30,000-bbl. per day refinery at



This SWECO-built refinery addition helped an Indiana plant pull from behind to a front position in the race to upgrade gasoline.

High Octane Package Handled with Care

Like many refineries, the Mt. Vernon plant of the Indiana Farm Bureau Association was caught with its rating down when the latest high octane race started. That was before SWECO wrapped up a $1,500,000 refinery package that included a 3,000 BPSD platformer, a 2,100 BPSD unifiner, and a new steam generating plant with an hourly capacity of 120,000 lb. of high-pressure steam.

Off and running

The platformer-unifiner team went on stream in November, 1956, and has been in continuous operation ever since. This combination unit, built under license from Universal Oil Products Company, makes Mt. Vernon a front runner in today's race to upgrade gasoline.

In planning the steam generating plant, SWECO engineers decided to save time by specifying the equipment and letting bids for fabrication. But outsiders couldn't meet the cost estimates or contract, so SWECO built the pressure vessels in its Los Angeles plant. They were delivered three days ahead of schedule.

Problems in stride

Heavy spring washouts and a tight budget were just some of the problems the SWECO engineering and construction crews took in stride. Designing and building moderate-size refinery installations is their specialty.

This is the kind of service, the extra service SWECO clients in the process industries expect. Large or small, at home or abroad, it's the only kind they get . . . in the *engineering and construction* of refineries (SWECO *is licensed to build plants for practically all major refining processes*), chemical plants and ore beneficiating mills . . . in the design and manufacture of *process equipment* such as heat exchangers, steam jet ejectors and distillation columns . . . in a full line of *vibrating screen separators.*

Write today for our new brochure on how SWECO products and services can help meet your processing needs. Ask for brochure E-2-317.

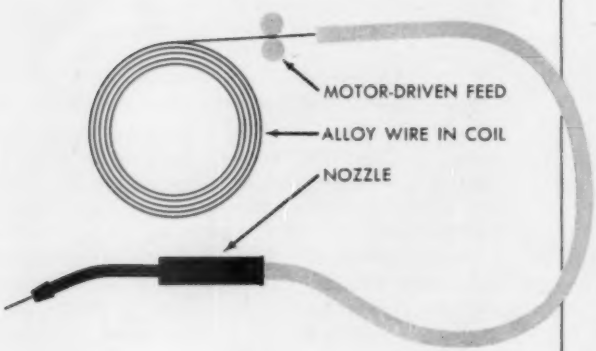
SWECO

Southwestern Engineering Company

4800 Santa Fe Ave., Los Angeles 58, Calif.

WHAT IS *SEMI-AUTOMATIC* HARD-FACING?

Here is one of industry's newest maintenance tools used to radically reduce hard-facing costs. It is simple, highly versatile and can be installed at moderate price.



Semi-automatic hard-facing is a process which combines the high deposit rates of automatic welding with the positioning and setup convenience of the manual method. It utilizes a complete series of Stoody fabricated tubular wires containing alloys that meet all hard-facing requirements. These wires, supplied in layer wound coils, are mechanically fed to the nozzle by the semi-automatic welding machine. The weldor merely directs the arc as the metal is deposited on the work, the machine automatically starting the wire feed when the arc is struck, stopping it when the arc is broken. Numerous advantages result when rebuilding and maintaining equipment in all types of heavy industry.

Repointer welded on with Stoody Nickel Manganese and entire tooth hard-faced with Stoody 121

Roll brought up to size with Stoody Nickel Manganese and corrugations rebuilt with Stoody 100

HIGH WELDING SPEEDS—Two to four times faster than the manual method at correct welding amperages, semi-automatic hard-facing effects enormous savings in time. Penetration of the base metal and dilution of the deposit are reduced, with lower heat input, all highly desirable features of this process.

FULL VISIBILITY—No submerging flux is required; the weldor enjoys complete visibility of the weld at all times. Flux dams are unnecessary.

NO STUB END LOSSES—Wires are supplied in continuous coils. There is no stub end waste nor time lost in changing electrodes.

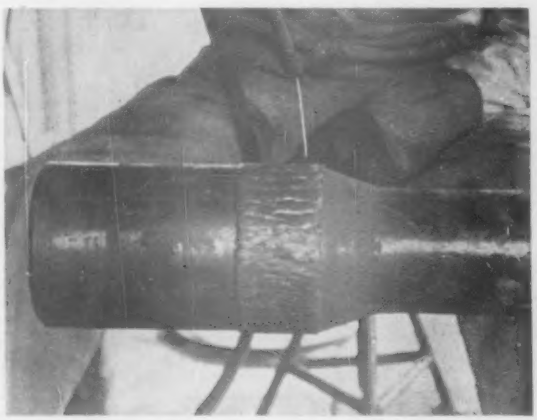
SEMI-AUTOMATIC MACHINES—Now supplied by a number of manufacturers, all can be used satisfactorily with Stoody semi-automatic wires with minor conversions consisting of wire guides, nozzle and nozzle tip. Conversion kits are available from all Stoody distributors.

WHERE CAN SEMI-AUTOMATIC HARD-FACING BE ECONOMICALLY USED?—In general, almost any work now hard-faced manually can be completed faster and cheaper semi-automatically with deposits having wear resistance usually superior to manual electrodes of similar analysis. The illustrations are typical of current semi-automatic applications.

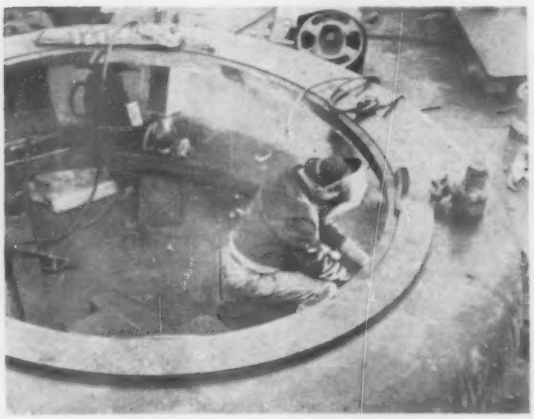
Write for circular. Contains a full description of present Stoody semi-automatic wires and typical applications.
Available from your Stoody dealer.
Check the "Yellow Pages" of your phone book or write direct.

Shovel track pads rebuilt with Stoody Nickel Manganese

Mill hammers brought up to size with Stoody Nickel Manganese, using copper form, then hard-faced with Stoody 100



Tool joints hard-faced with Stoody 130 or Stoody 100



Dredge pump casing hard-faced with a combination of Stoody 121 and Stoody 100

STOODY COMPANY
11938 EAST SLAUSON AVENUE
WHITTIER, CALIFORNIA

SEE OUR BOOTH NO. 144, WELDING SHOW, PHILADELPHIA, APRIL 9-11

Providence, R. I. Lummus Co. is contractor.

Commonwealth Oil Refining Co. will increase crude capacity 35,280 bbl. per day, capacity of vacuum unit charging topped crude 20,700 bbl. per day, Houdriflow capacity 26,800 bbl. per day with 50 per cent recycle, Houdriforming capacity 3,730 bbl. per day, and catalytic polymerization 1,470 bbl. per day at Guayanilla, Puerto Rico, by September 1957. Lummus Co. is contractor.

Continental Oil Co. will complete a 3,500-bbl. per day catalytic reformer at Denver by August 1957. Refinery Engineering Co. has contract.

At Westlake, La., a 10,000-bbl. per day delayed coker will be completed by November 1957.

At Ponca City, Okla., an 11,000-bbl. per day catalytic reformer and a 16,000-bbl. per day hydrodesulfurization unit will be completed by July 1957. M. W. Kellogg is contractor for the reforming unit.

Corpus Christi Refining Co. plans a $560,000 modernization program at Corpus Christi, Tex. Plant will be idle until June 1957, while program is under way.

D

Delhi-Taylor Oil Corp. will increase Platforming capacity by 10,500 bbl. per day, and add a 15,000-bbl. per day Unifiner at Corpus Christi, Tex., by June 1957. Engineering and design are by Refinery Engineering Co. and U.O.P. Cost is close to $7,000,000.

Delta Refining Co. will increase crude capacity by 20,000 bbl. per day, increase capacity of vacuum unit charging topped crude by 3,600 bbl. per day, increase T.C.C. capacity by 9,500 bbl. per day with a 16 per cent recycle, and add a catalytic polymerization unit with 860 bbl. per day capacity at Memphis, Tenn., by December 1957.

Douglas Oil Co. of California will increase crude capacity at Bakersfield, Calif., by 12,000 bbl. per day by December 1957.

D-X Sunray Oil Co. will complete a 6,000-bbl. per day Unifiner at Duncan, Okla., in 1958. Refinery Engineering Co. is contractor.

At West Tulsa, Okla., a 12,000-bbl. per day Platformer, a 20,000-bbl. per day Unifiner, a 3,000-bbl. per day hydrofluoric acid alkylation unit, and 2,000 bbl. per day of butane isomerization will be added in 1958. Engineering and design are by Refinery Engineering Co. and U.O.P.

E

El Paso Natural Gas Products Co. will complete a 6,500-bbl. per day refinery near Odessa, Tex., by November 1957. It will handle Platforming, fluid catalytic cracking, a vacuum unit, and a hydrofluoric acid alkylation unit. Engineering and construction is by Southwestern Engineering Co.

Esso Standard Oil Co. will increase sulfuric acid alkylation capacity by 1,000 bbl. per day at Baton Rouge, La. by June 1957. Gas-oil cracking capacity will be increased by 5,000 bbl. per day and lube production by 150 bbl. per day by December 1957.

Esso Standard Oil Co. will complete a 7,200-bbl. per day Powerformer and a 7,200-bbl. per day Hydrofining (Esso) unit at Everett, Mass., by August 15, 1957. Blaw-Knox has contract for the Powerformer.

Esso Standard Oil Co. will increase Hydrofining (Esso) capacity by 20,000 bbl. per day and add a 20,000-bbl. per day Powerformer at Linden, N. J., by July 1957. Foster Wheeler Corp. has contract. A 10,230-bbl. per day sulfuric acid alkylation unit will be added by November 1957, by Ralph M. Parsons Co.

Evangeline Refining Co., Inc., will add a 1,000-bbl. per day Catformer at Jennings, La.

F

Farmers Union Central Exchange will complete a 4,400-bbl. per day Platformer and a 12,200-bbl. per day Unifiner at Laurel, Mont., by March 1958.

Frontier Oil Refining Co., Division of Ashland Oil & Refining Co. will have completed a 6,500-bbl. per day Houdriforming unit, constructed by Blaw-Knox Co. at a cost of $2,000,000, and a 10,000-bbl. per day Hydrofining unit of its own design at North Tonawanda, N. Y., by February 1, 1957.

Frontier Refining Co. is increasing crude capacity 2,500 bbl. per day in two stages at Cheyenne, Wyo. Part of the increase will have been completed February 1, 1957, at which time capacity of vacuum unit charging topped crude will have been increased 4,000 bbl. per day. Remaining increase in crude capacity, plus a 1,800-bbl. per day increase in straightrun asphalt capacity, will be completed by July 1, 1957.

G

General Petroleum Corp. will complete a 12,000-bbl. per day Sovaformer at Torrance, Calif., in October 1957. Ralph M. Parsons Co. has contract.

At Ferndale, Wash., Sovaforming capacity will be increased 9,000 bbl. per day by September 1957. Bechtel Corp. is contractor.

Golden Bear Oil Co. will have increased crude capacity 500 bbl. per day at Oildale, Calif., by March 1957. Engineering is by D. Reynolds. Cost is $100,000.

Gulf Oil Corp. will add a 40,000-bbl. per day Gulfining capacity at Philadelphia by April 1957. M. W. Kellogg Co. is contractor. A 3,500-bbl. per day sulfuric acid alkylation unit will be completed in August 1957, by Ralph M. Parsons Co. In 1958, Platforming capacity will be increased 52,000 bbl. per day. Platformer engineering and design are by Procon, Inc., and U.O.P.

Construction of a new refinery near Charleston, S. C., is being considered. Gulf has bought over 2,000 acres and holds an option on an additional 1,000 acres. It is reported the option will be exercised soon.

At Port Arthur, Tex., sulfuric acid alkylation capacity will be increased 2,500 bbl. per day by April 1957. M. W. Kellogg is contractor. Platforming capacity will be increased 26,000 bbl. per day in 1958.

H

Humble Oil & Refining Co. will increase sulfuric acid alkylation capacity 2,300 bbl. per day at Baytown, Tex., by April 1, 1957. Two hydrodesulfurization units with 90,000-bbl. per day capacity will be completed January 1, 1958, by Ralph M. Parsons Co. A 55,000-bbl. per day fluid catalytic cracker with no recycle will be completed by February 1, 1958. Engineering and design of the catalytic cracker are by Foster Wheeler Corp. and Humble.

Husky Oil & Refining, Ltd., plans crude expansion at Lloydminister, Alta., but plans are not complete.

Crude expansion and a new diesulforming unit are planned for Fort William, Ont. A 250-bbl. per day oxidized asphalt unit will be completed July 1, 1957.

Crude expansion is planned for the Moose Jaw, Sask., plant, but plans are not complete.

I

International Refineries, Inc., will add a 2,800-bbl. per day Powerformer and a 2,800-bbl. per day Hydrofining

BROADER WINGS FOR THE FLYING A

Tidewater Oil Company recently completed the first phase of a major expansion program which gave its Avon Refinery, on San Francisco Bay, both increased output and the ability to manufacture new and improved products under the familiar Flying A banner. Total capacity was raised substantially. Among new facilities is a 42,000 barrel Fluid Coking Unit, the world's largest.

Bechtel furnished design, procurement and construction . . . an integrated project under single responsibility.

BECHTEL CORPORATION *Builders for Industry*
SAN FRANCISCO • Los Angeles • New York • Houston
CANADIAN BECHTEL LIMITED, Toronto • Vancouver

BECHTEL

unit at Wrenshall, Minn., by April 1957. Ralph M. Parsons Co. has contract.

Imperial Oil, Ltd. will complete a 5,800-bbl. per day Powerformer at Ioco, B. C., in December 1957.

Crude capacity will be increased 2,650 bbl. per day, and fluid catalytic cracking capacity 1,500 bbl. per day with 23 per cent recycle, at Winnipeg, Man., in 1957. A 3,150-bbl. per day Powerformer will be completed in October 1957. Foster Wheeler Corp. has contract.

At Halifax, N. S., a 7,000-bbl. per day Powerformer will have been completed by Foster Wheeler Corp. by March 1957.

At Sarnia, Ont., Hydrofining (Esso) capacity will be increased 3,400 bbl. per day early in 1957. A 15,000-bbl. per day Powerformer will have been completed in January 1957.

At Montreal East, Que., a 9,450-bbl. per day Powerformer will be completed by April 1957. Fluor Corp. of Canada, Ltd., is contractor. Engineering and design are by Esso.

K

Kendall Refining Co. will complete a 2,000-bbl. per day Unifiner at Bradford, Pa., the second quarter of 1957.

Kerr-McGee Oil Industries, Inc., will complete a 5,500-bbl. per day Platformer and a 4,000-bbl. per day Unifiner at Wynnewood, Okla., by July 1, 1958.

L

Lake Charles Chemical Corp. (wholly owned subsidiary of Continental Oil Co.) will complete by September 15, 1957, a 10,000-bbl. per day delayed coker to produce 330 tons per day of coke at Continental's Westlake, La., plant. Fluor Corp. is contractor.

Lake Superior Refining Co. will increase crude capacity 3,500 bbl. per day, Platforming capacity 1,000 bbl. per day, and add a 4,300-bbl. per day Unifiner at Superior, Wis., by October 15, 1957.

Louisville Refining Co. will have increased its Platforming capacity 2,000 bbl. per day, and added a 2,000-bbl. per day Unifiner at Louisville, Ky., by March 1, 1957.

M

Magnolia Petroleum Co. will complete a 100,000-bbl. per day atmospheric distillation unit and a 32,000-bbl. per day vacuum unit for charging topped crude (both to replace some existing capacities) at Beaumont, Tex., by March 1958. Foster Wheeler Corp. is contractor. A 30,000-bbl. per day Sovafiner will be completed, and sulfuric acid alkylation capacity increased 8,000 bbl. per day by March 1958.

Malco Refineries, Inc., will have completed a 900-bbl. per day HF alkylation unit at Artesia, N. M., by March 1, 1957.

McColl-Frontenac Oil Co., Ltd. will complete a 3,000-bbl. per day Unifiner-Platformer at Edmonton, Alta., early in 1957. Engineering and design are by Refinery Engineering Co. and U.O.P.

At Montreal East, Que., a 10,000-bbl. per day hydrotreating unit will be completed in late 1957.

McMurrey Refining Co. will increase Platforming capacity 5,200 bbl. per day, and add a 3,200-bbl. per day Unifiner at Tyler, Tex., by June 1958.

Mohawk Petroleum Corp. is adding a 925-bbl. per day Unifining unit at Bakersfield, Calif. Completion is set for June 1957.

N

Nap-Sol Refining Co. will increase crude capacity 3,500 bbl. per day at Muskegon, Mich., by October 1, 1957.

North American Petroleum Corp. plans a new refinery at Corpus Christi, Tex. Site has been purchased, but plant is not yet under construction.

Northwestern Refining Co. will increase crude capacity 3,000 bbl. per day at St. Paul Park, Minn., by April 1, 1957.

P

Panhandle Oil Co. will increase crude capacity 1,000 bbl. per day, fluid catalytic cracking capacity 500 bbl. per day with 23 per cent recycle, catalytic polmerization capacity 150 bbl. per day, and add a 3,000-bbl. per day Platformer at Wichita Falls, Tex., by July 1957.

Paragon Oil Co. plans a refinery at Riverton, R. I.

Phillips Petroleum Co. is building a 3,000-bbl. per day fluid catalytic cracker with 63 per cent recycle at Great Falls, Mont. Completion is set for summer of 1957. Procon, Inc., has contract.

Phillips Petroleum Co. and Pacific Petroleums, Ltd. are building a $15,000,000 plant at Taylor, B. C. It will include distillation, catalytic desulfurization and reforming, dehydrogenation, butane isomerization, and alkylation. Pacific Petroleums, which will be the operator, will build the refining units, and Phillips will build the avgas unit.

Pontiac Eastern Corp. will complete an 11,000-bbl. per day refinery at Hattiesburg, Miss., by September 1957. Construction and engineering are being done by Fluor Corp., Ltd. The plant will include a 3,500-bbl. per day fractionation unit for purchased distillates, a 4,800-bbl. per day fluid coking unit, a 25,700-bbl. per day T.C.C. unit with 63 per cent recycle, a 2,500-bbl. per day sulfuric acid alkylation unit, coke capacity of 225 tons per day, a 1,200-bbl. per day Unifiner, and a 2,500-bbl. per day Platformer.

Premier Oil Refining Co. of Texas will have added 500 bbl. per day crude capacity and 300 bbl. per day thermal processing capacity through a revamping program at Longview, Tex., by February 1957. A 1,500-bbl. per day Platformer will be completed in April 1957, and a 1,500-bbl. per day Unifiner will be completed in May 1957.

Pure Oil Co. will add a 12,000-bbl. per day Sinclair-Baker catalytic reforming unit and a 17,000-bbl. per day Kellogg unit at Lemont, Ill., by fall of 1957. M. W. Kellogg Co. is contractor.

R

Regent Refining (Canada), Ltd., will increase crude capacity 20,000 bbl. per day, add an 8,000-bbl. per day vacuum unit for charging topped crude, add an 11,300-bbl. per day fluid catalytic cracker with 61.5 per cent recycle, and add a 730-bbl. per day catalytic polymerization unit at Port Credit, Ont., by summer 1957. Engineering and design are by Procon (Canada), Ltd., and U.O.P.

Richfield Oil Corp. plans a new refinery at Everett, Wash.

Rock Island Refining Corp. will increase its Platformer capacity by 400 bbl. per day and its Unifiner capacity by 4,600 bbl. per day at Indianapolis by August 1, 1957.

Royalite Hi-Way, Ltd. will increase crude capacity 500 bbl. per day at Saskatoon, Sask., by August 1957.

Royalite Oil Co., Ltd. will complete a 1,000-bbl. per day Platformer and a 1,500-bbl. per day Unifiner at Kamloops, B. C., in October 1957.

S

Salt Lake Refining Co. will increase crude capacity 3,000 bbl. per day, and capacity of vacuum unit charging topped crude 2,000 bbl. per day at Salt

Lake City, by June 1957. A 6,000-bbl. per day Platformer will be added by November 1957.

Seminole Oil Co. has indefinite plans for a refinery at Fort Pierce, Fla., to be operated by Frontier Refining Co.

Shamrock Oil & Gas Corp. will increase crude capacity 4,000 bbl. per day by April 1, 1957, and increase sulfuric acid alkylation 1,100 bbl. per day by fall of 1957, at Sunray, Tex. Catalytic Construction Co. has contract.

Shell Oil Co. is building a 16,000-bbl. per day Platformer at Wilmington, Calif. Kaiser Engineers is engineering and constructing the unit.

At Anacortes, Wash., a 2,500-bbl. per day sulfuric acid alkylation unit will be added. Fluor Corp., Ltd., has the multimillion-dollar construction job.

Shell Oil Co. of Canada, Ltd., will complete a 3,300-bbl. per day combination straightrun and oxidized asphalt unit at Montreal East, Que., in June 1957. A 1,500-bbl. per day sulfuric acid alkylation unit will be completed in 1958, by Refinery Engineering Co.

Sinclair Refining Co. will add a 7,500-bbl. per day Sinclair-Baker catalytic reformer at Hartford, Ill., by July 1, 1957. Arthur G. McKee & Co. has contract..

At Houston, 24,000-bbl. per day Sinclair Hydrofining capacity will be added by September 1, 1957. Ralph M. Parsons Co. has contract.

Sioux Oil Co. will increase crude capacity 500 bbl. per day at Newcastle, Wyo., by July 1, 1957.

Skelly Oil Co. will complete a 3,500-bbl. per day Phillips HF alkylation unit at El Dorado, Kans., by the spring of 1958. Engineering and construction will be handled by Skelly personnel.

Socony Mobil Oil Co., Inc., will complete a 9,000-bbl. per day catalytic reforming unit at Augusta, Kans., in August 1957. J. F. Pritchard Co. is contractor.

At Trenton, Mich., a 3,500-bbl. per day sulfuric acid alkylation unit will be completed in December 1957, by Fluor Corp., Ltd.

At Paulsboro, N. J., a 22,000-bbl per day hydrodesulfurizer will be completed in July 1957, by Foster Wheeler Corp.

At Buffalo a 2,900-bbl. per day sulfuric acid alkylation unit will be completed in September 1957, by M. W. Kellogg Co.

At Casper, Wyo., a 3,000-bbl. per day catalytic reforming unit and a 3,250-bbl. per day hydrodesulfurization unit will be completed in November 1957, by J. F. Pritchard Co.

Southland Co. plans a 15,000-bbl. per day refinery at Black Point, Fla. Site has been purchased.

Standard Oil Co. of California will increase crude capacity 12,000 bbl. per day, and capacity of vacuum unit charging topped crude by 20,000 bbl. per day at El Segundo, Calif., in 1957. Fluor Corp., Ltd., is contractor for vacuum unit.

At Richmond, Calif., crude capacity will be increased 38,000 bbl. per day in 1957.

A new refinery with from 60,000 to 100,000 bbl. per day crude capacity is planned for Everett, Wash.

Standard Oil Co. (Ind.) is adding a 6,000-bbl. per day Ultraformer and a 6,000-bbl. per day Hydrofining (Indiana Standard) unit at Neodesha, Kans. Completion is set for 1958. Foster Wheeler Corp. has contract.

At Wood River, Ill., a 15,000-bbl. per day Hydrofining unit will have been completed in March 1957.

At Whiting, Ind., Ultraforming capacity will be increased 21,000 bbl. per day and Hydrofining capacity 30,000 bbl. per day by May 1957. Arthur G. McKee & Co. has contract for Ultraformer. In 1958, another 21,000 bbl. per day will be added to Ultraforming capacity and an additional 21,000 bbl. per day added to Hydrofining capacity. Ralph M. Parsons Co. has contract for the second Ultraformer.

At Sugar Creek, Mo., a 3,800-bbl. per day sulfuric acid alkylation unit will be completed by Foster Wheeler Corp., early in 1957.

At Casper, Wyo., capacity of vacuum unit charging topped crude will be increased 4,800 bbl. per day, and lube production 380 bbl. per day by May 1957. Foster Wheeler Corp. has contract.

Standard Oil Co. (Ohio) will complete a 3,500-bbl. per day sulfuric acid alkylation unit at Cleveland by mid-1958. Arthur G. McKee & Co. has contract.

At Toledo, construction is under way to replace present crude, thermal processing, and polymerization units. Crude capacity will be 60,000 bbl. per day, capacity of vacuum unit to charge topped crude will be 23,000 bbl. per day, polymerization capacity will be 1,650 bbl. per day, and delayed coking will be 8,000 bbl. per day to produce 350 tons per day of coke. Units being added to the plant include a 55,000-bbl. per day fluid catalytic cracker with 45 per cent recycle, a 12,000-bbl. per day Sinclair-Baker catalytic reformer, and a 22,500-bbl. per day Kellogg Hydrofining unit. Completion is set for mid-1958. M. W. Kellogg Co. is contractor.

Standard Oil Co. of Texas will increase crude capacity 28,000 bbl. per day, capacity of vacuum unit charging topped crude 13,200 bbl. per day, add a 13,500-bbl. per day fluid catalytic cracker, and add a 2,025-bbl. per day catalytic polymerization unit at El Paso, Tex., by February 1958. Fluor Corp., Ltd., is contractor for the catalytic cracker.

Sunset International Petroleum Corp. (formerly Sunset Oil Co.) will have added 800 bbl. per day capacity to its Thermofor unit and 100 bbl. per day capacity of thermal polymerization at Torrance, Calif., by March 1957.

Sunshine State Refineries, Inc. plans a 10,000-bbl. per day refinery at Plant City, Fla.

Suntide Refining Co. will complete a 15,000-bbl. per day Rexformer and a 7,500-bbl. per day Unifiner at Corpus Christi, Tex., by June 1957. A 7,500-bbl. per day BTX Udex will be completed by September 1957, and capacity of vacuum unit charging topped crude will be increased 8,500 bbl. per day by October 1957. Refinery Engineering Co. is contractor.

T

Texas City Refining, Inc. will increase Houdriflow capacity 1,000 bbl. per day with no recycle, and will add a 7,000-bbl. per day Houdriformer and a 7,000-bbl. per day Houdry unit at Texas City, Tex., by late 1957. Catalytic Construction Co. has contract for the Houdriformer. Cost will be $2,000,000.

The Texas Co. will increase both Platformer and Unifiner capacities 10,000 bbl. per day at Lockport, Ill., by October 1, 1957.

At Westville, N. J., a 12,000-bbl. per day Visbreaker will have been completed by Refinery Engineering Co., by March 1, 1957.

At Port Arthur, Tex., crude capacity will be increased 20,000 bbl. per day by January 1, 1958. Fluor Corp., Ltd., is contractor. Capacity of vacuum unit charging topped crude will be increased 32,000 bbl. per day by January 1, 1958. By April 1, 1958, M. W. Kellogg Co. will have completed work to increase fluid catalytic cracking capacity 90,000 bbl. per day with 33.3 per cent recycle.

A 40,000-bbl. per day refinery will be completed at Anacortes, Wash., by

January 1, 1959. It will include a 16,000-bbl. per day vacuum unit for charging topped crude, a 25,000-bbl. per day fluid catalytic cracking unit, a 7,000-bbl. per day U.O.P. Platformer, a 7,000-bbl. per day Unifiner, an 11,000-bbl. per day hydrotreating unit, a 2,000-bbl. per day sulfuric acid alkylation unit, and a 1,000-bbl. per day catalytic polymerizatiotn unit. Bechtel Corp. is contractor.

Tidewater Oil Co. will complete a 22,500-bbl. per day Houdriformer at Avon, Calif., by March 1958. Bechtel Corp. is contractor.

U

Union Oil Co. of California is building a 14,500-bbl. per day Platformer and a 15,750-bbl. per day Unifiner at Wilmington, Calif. C. F. Braun & Co. has the engineering and construction. Completion is set for May 1957.

United Refining Co. will have completed a 4,000-bbl. per day fluid catalytic cracker with 37.5 per cent recycle, and a 225-bbl. per day catalytic polymerization unit at Warren, Pa., in March 1957. Both processes are licensed by U.O.P. Procon, Inc. has construction contract.

U. S. Oil & Refining Co. will complete a 15,000-bbl. per day refinery at Tacoma, Wash., in May 1957. It will include a 10,000-bbl. per day combination topping, vacuum, and thermal cracking unit, a 2,500-bbl. per day Houdriformer, and a catalytic polymerization unit. Holmes & Narver is building the reformer.

V

Vickers Petroleum Co., Inc. will complete in May 1957, a 3,500-bbl. per day Ultraformer at Potwin, Kans. Ralph M. Parsons Co. has contract.

Vulcan Asphalt Refining Co. will have added 2,500-bbl. per day crude capacity, a 1,110-bbl. per day asphalt capacity at Cordova, Ala., by February 1957.

W

Wainwright Producers & Refiners, Ltd. will increase crude capacity 4,500 bbl. per day at Wainwright, Alta., in the spring of 1957. A 3,000-bbl. per day gas-oil cracking unit will be completed in the fall of 1957. A 600-bbl. per day Platformer, a Unifiner, and a 50-bbl. per day catalytic polymerization unit are planned for 1957.

Westland Oil Co. will increase crude capacity 2,000 bbl. per day at Williston, N. D., by April 1957. A 1,000-bbl. per day gas-oil cracking unit will be added by June 1957, and Platforming capacity will be increased 600 bbl. per day by September 1957.

Wickett Refining Co. will complete a 1,000-bbl. per day Catformer and a 1,000-bbl. per day Unifiner at Wickett, Tex., by October 1, 1957.

Wilshire Oil Co. of California will complete a 10,000-bbl. per day Platformer and a 10,000-bbl. per day Unifiner at Norwalk, Calif., by April 1, 1957. Engineering and construction are by Southwestern Engineering Corp. Processes are licensed by U.O.P.

Real Pot Of Gold

Rainbow Pier's Oil Worth $220 Million

LONG BEACH.—This resort city has found its pot of gold at the end of Rainbow Pier.

The city christened the famous amusement center in 1929. Little did the city fathers realize that the pier would live up to its name in a way other than its semicircular shape. In 1939 the huge Wilmington oil field was found to extend under Long Beach Harbor just west of Rainbow Pier.

Figures released recently revealed the city has received $220,591,811 from this pot of gold in the form of royalties.

The Long Beach Oil Development Co., operator of the city's share of the Wilmington field, has drilled 852 wells since the beginning of its contract with Long Beach. Of this number, 712 are still producing, 83 have been abandoned, 7 are being used for gas injection and 2 for water injection. Forty-eight are idle. Total crude production since the life of the contract has been 186,657,916 bbl.

Last year, the state cut itself in for a large slice of this windfall. It claimed ownership of half the crude and all the dry gas revenues. The courts upheld the state's claim. In a compromise settlement, Long Beach recently handed the state a check for $120 million as the state's share of $170 million of crude and dry gas funds held in trust by the city.

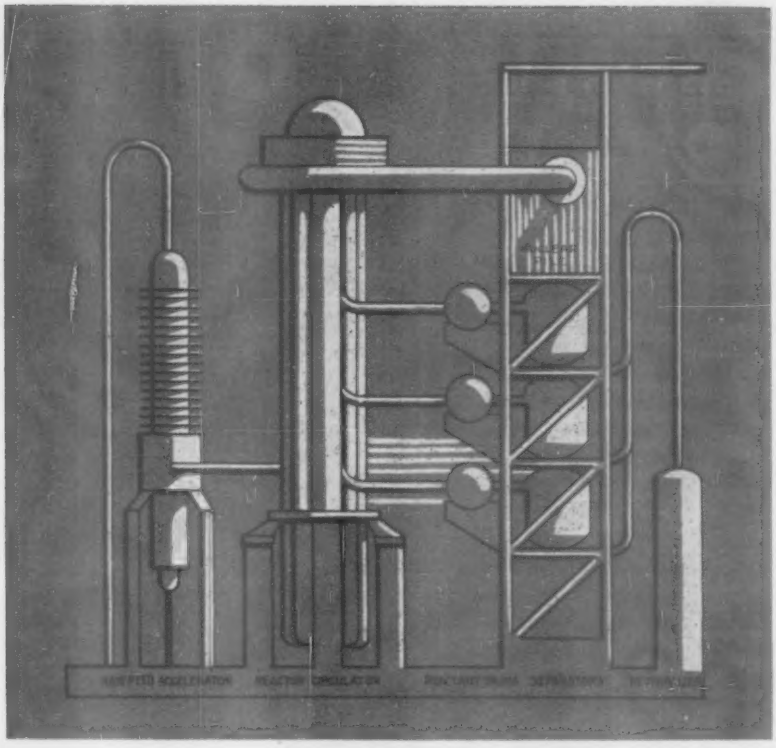
Shutdown Plants in the United States

Company and location—	Cap., bbl. per stream day
California	
Superior Asphalt Co., Oxnard	2,000
Illinois	
Harmony Oil Corp., Salem	2,500
Kentucky	
Aetna Div., Ashland Oil & Refining Co., Louisville	10,000
Montana	
Hunt, Eugene, Winnett	300
Modern Oil Co., Inc., Shelby	1,000
Ohio	
Ashland Oil & Refining Co., Niles	6,000
Oklahoma	
Wilcox Oil Co., Bristow	5,300
Texas	
Anderson Refining Corp. of Dallas, Palestine (formerly Corpus Christi Refining Co.'s plant)	3,500
Corpus Christi Refining Co., Corpus Christi (will be idle from January through June 1957, for modernization)	8,500
Sid Richardson Refining Co., Texas City	18,000
Wyoming	
Continental Oil Co., Glenrock	4,100
Pilot Oil Co., Morton	200

Summary of Operating Refineries in Mexico

Company—Refinery location—	Bbl. per stream day— Crude dist.	Cracking
18 de Marzo—Atzcapotzalco	100,000	(*)
Ing. Antonio M. Amor—Salamanca	†40,000	‡5,300
Madero—Madero	§89,000	¶5,500
Arbol Grande—Arbol Grande	40,000	.....
Mata Redonda—Villa Cuauhtemoc	14,000	6,000
Reynosa—Reynosa	10,000	2,000
Poza Rica—Poza Rica de Hidalgo	‖97,000	.....
Minatitlan—Minatitlan	50,000	10,000
Total	440,000	28,800

*A 20,000-bbl. fluid cat cracker planned. †A 30,000-bbl. crude distillation unit planned. ‡A 10,000-bbl. cat cracker planned. §A 50,000-bbl. crude-distillation unit planned. ¶A 20,000-bbl. cat cracker planned. ‖Includes 90,000-bbl. crude stabilization capacity.



A New Tool For a New Era

Oil-company research and development departments are working full speed ahead to put the atom to work in petroleum processing. Other college and industrial laboratories are working along these lines too. As yet there are no commercial applications of radiation processing, but some facts are becoming known.

Here are statements by eight well-known authorities which summarize where we are and show us where we might be going in this new field.

The drawing at left is our art director's idea of the radiation-processing plant of the future. It looks a bit far-fetched to us, but we aren't able to prove him wrong. We'll know more about it 25 years from now.

RADIATION PROCESSING

"Initial uses . . . will be for specialty and petrochemical products"

by H. J. Ogorzaly

INCREASINGLY frequent references in the technical literature to the installation of radiation facilities in the research laboratories of the petroleum industry illustrates the high level of current interest in the possibilities of radiation processing. As yet, no commercial application to refining or petrochemical operations has been announced, and very little has been published by the industry on the results of its research in this field. However, a few general comments may be made concerning the nature and utility of radiation and its process applications.

Highly energetic radiation sources are of three general types:

1. Particle accelerators.
2. Long-lived radioactive isotopes produced in nuclear piles, but utilized externally.
3. Nuclear piles, including short-lived isotopes in a stream continuously reactivated by circulation through an operating pile.

The author is assistant director, Petroleum Development Division, Esso Research & Engineering Co., Linden, N. J.

Particle accelerators for industrial use are currently available in the form of Van de Graaff machines, resonant transformers, and linear accelerators. Bascally, all of these machines produce a stream of high-energy electrons. The characteristic features of this type of radiation are low penetrating power and high intensity of irradiation which can be produced.

Among the long-lived isotopes cobalt-60 is the most prominent. It is now readily available in research quantities, and will probably be produced by pile irradiation in adequate quantity for commercial-process applications not requiring large dosage. Cesium-137 will probably be available as a byproduct of nuclear waste-disposal processes. Spent fuel elements have also been considered as possible sources of irradiation external to the pile. These have been used experimentally, but their application to commercial processing seems less likely than the use of more compact, more easily transportable, and longer-lived specially prepared isotopes. On disintegration, radioactive isotopes yield primarily gamma rays (high-energy X-rays) of much higher penetrating power than electron beams. The intensity of irradiation possible with available isotopic sources is considerably lower than with electron beams.

Short-lived isotopes, for example, sodium-24 and indium-116, are possible sources of gamma radiation. These would be available only in close association with the operation of a pile. Reactants could also be introduced directly into operating piles, to be exposed to intense gamma irradiation and to the highly penetrating neutron flux.

This technique would involve possible radioactivity of the product stream, as a result of the absorption of neutrons by traces of sulfur and metals.

All forms of energetic radiation are believed to play their part in promoting chemical reactions by stripping electrons from the outer shells of the irradiated atoms, giving rise to ions and free radicals. These are the active participants in chemical reactions. They are ordinarily produced by heat or catalysis. The particular advantage of radiation is that these active entities can be created at temperatures which are much lower than those normally employed and without the possibilities of product contamination, equipment corrosion, and loss of activity which are not infrequently associated with the use of conventional catalytic techniques.

At present, all highly energetic radiation is expensive. Costs are on the order of several dollars per kilowatt-hour absorbed. This means that radiation cannot be economically employed to supply the necessary energy for reactions not favored by thermodynamics. Its effectiveness is greatest when it can be employed to trigger a reaction which is thermodynamically favored, and which proceeds by a chain-reaction mechanism, in which the initiating entities will be repeatedly regenerated as the reaction proceeds. Several reactions familiar in petroleum and petrochemical work, such as cracking and olefin polymerization, are of this chain-reacting type.

It seems very likely that the initial uses of radiation processing in the petroleum industry will be for the production of specialty and petrochemical products. Additives, rubbers, and plastics are typical of this field. The reactions by which such polymeric products are formed frequently meet the indicated specifications of favorable thermodynamics and chain-reacting mechanisms. In conjunction with their relatively high unit value, this suggests that the use of radiation, even at its current high cost level, may be economically supportable. Since, in most cases, competitive catalytic techniques are presently available for carrying out similar reactions, demonstration of improved product quality and performance will be important in determining the rapidity and scale on which radiation processing develops, even in this high-value area.

In the fuels process field, radiation processing faces a much more difficult barrier, since unit values and processing costs by conventional techniques are relatively low. It may well be that the commercial application of radiation processing to fuels production will have to wait on the development of a much advanced pile technology and the availability on a large scale of cheap by-product radiation from nuclear piles installed primarily for heat and power production. Meanwhile, the ability of radiation to produce reactive entities at low temperatures may prove to be extremely significant in discovering reactions not heretofore observed, and suggesting radically new approaches to desirable hydrocarbon conversions.

"Industrial future is . . . in quest for new processes which should become possible"

by Milton Burton

WORK in the radiation project laboratories at the University of Notre Dame has been concerned primarily with detailed mechanism of radiolysis. Our studies of the radiolysis of hydrocarbons and related compounds have enabled us to vary in very gradual degree the parameters which might be responsible for the various effects observed.

Lately, we have been studying multicomponent mixtures which luminesce, i.e., scintillate, under the impact of high-energy radiation with a spectrum characteristic of a trace solute. The results are correlated with chemical studies and in this way we are making progress on the mechanism of the energy-transfer processes involved in radiolysis.

Work of this kind is certainly more complicated than the earlier phenomenological studies of the production of decomposition products from single pure compounds. However, the latter are by no means simple. Mass spectrometric studies (at Shell, Humble, Notre Dame, etc.), in which the gas studied is at pressures slightly higher than those employed ordinarily, indicate that ion + molecule reactions of the general type:

$$R^+ + R'H_2 \rightarrow RR'H_2^+ \rightarrow RR'^+ + H_2$$

may yield molecular growth processes.

In the last few years it has been usual to consider liquid-phase radio-

The author is professor of chemistry; director, radiation project, University of Notre Dame.

There are no higher quality standards in industry than those that govern the material, design and manufacturing of Harrisburg Pipe Flanges and Couplings. Are such high standards necessary? Users of Harrisburg products are convinced that they are because maintenance is a vitally important factor today with labor costs at an all-time high.

Harrisburg Drop-Forged Pipe Flanges are made to A.S.A. Specifications in threaded, butt welding, slip-on welding, Van Stone and blind types. Accurately controlled analysis, machining, and inspection assure uniformity that is important to oil field, utility and industrial users.

Harrisburg Seamless Steel Pipe Couplings are made to A.P.I. and A.I.S.I. Specifications and threaded by a special process, developed by our engineers, which produces threads of unsurpassed accuracy in form, height, angle and lead. Threads are electro-galvanized to prevent seizing.

Write for literature and prices.

More than a century in Harrisburg
Harrisburg Steel Co. | DIVISION OF HARSCO CORPORATION | HARRISBURG 6, PENNSYLVANIA

lytic reactions as mainly of the free-radical type.

However, the more recent observations on dilute gases will undoubtedly lead to a careful examination of the products of liquid-phase radiolysis of pure compounds with the expectation that unexpected reactions may be occurring there.

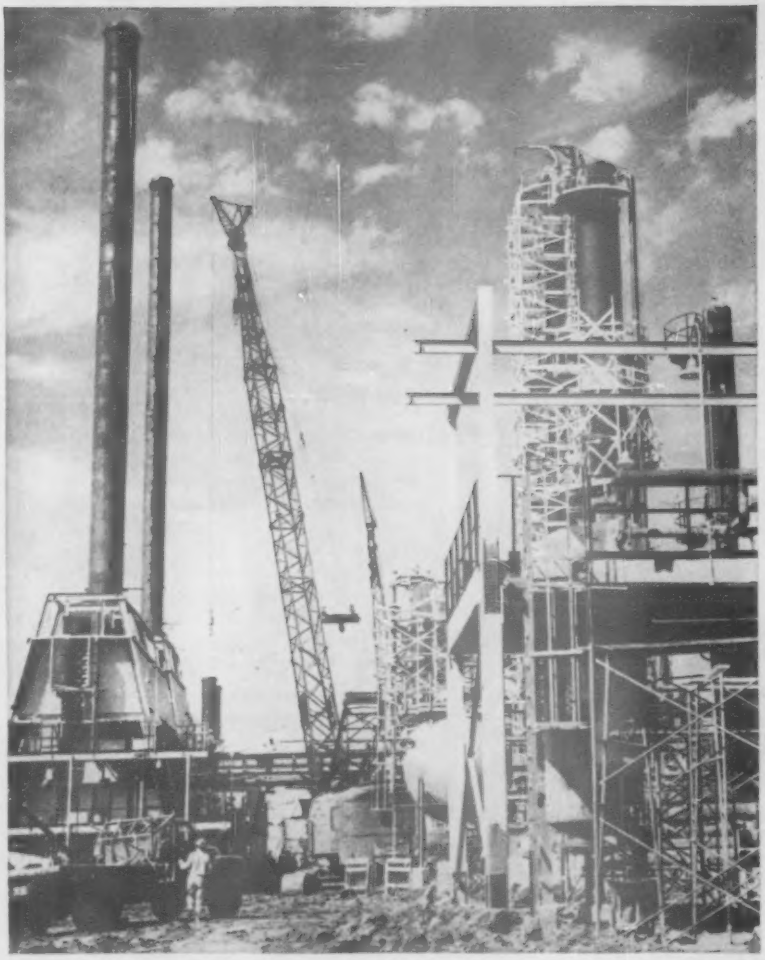
Energy transfer . . . At the same time, increased knowledge of energy-transfer mechanisms, of induced internal conversions, of the contribution of positive ions and of the peculiar results ensuant on negative-ion formation will ultimately lead to controlled processes of synthesis under high-energy radiation. These may differ markedly in efficiency and type not only from the conventional thermal and catalytic syntheses but also from the less orthodox photosynthetic processes which have proved so useful in many special cases.

Without question, the industrial future of radiation chemistry is not merely in modifying properties (as in polymers), or in avoiding degradative effects but in deliberate quest for new synthetic processes which should become possible with this revolutionary new tool. The use of internal radioactive sources (e.g., strong gamma or beta emitters) will make possible studies of high-pressure reactions both at elevated and low temperatures, such as cannot be examined by conventional phochemical methods.

Low-temperature studies may permit the freezing-in of free radicals produced by radiolysis in condensed systems until they are present in very high concentration; a slow rise in temperature thereafter will permit interradical reactions of magnitude and of intensity not at present attainable in any other way.

High-temperature processes in radiation chemistry, where the radiation source is used to trigger a phenomenon, are the more obvious way of employing radiation economically. The long reaction chains make of trivial significance the cost of the initial step.

Useful compounds . . . However, the more exciting prospects in the application of radiation chemistry lie in the possible production of useful compounds, polymers, etc., which cannot be produced in any other way. The fact that radiation chemistry makes available as significant intermediates very high and very low (e.g., triplet) excited states, ions and high concentrations of free radicals, at both low and high temperatures with a wide range of variable conditions, makes inevitable the discovery of new and important processes and the development of high-



CATS MULTIPLY FAST IN CANADA

Nowhere is Canada's swift industrial progress more striking than in the recent development of its oil refining and petrochemical facilities. Canada's daily refining capacity already approaches 700,000 barrels. New petrochemical plants are rising from coast to coast, to meet the demand for paints, alcohol, ammonia, plastics, detergents, synthetic rubber and other products of petroleum or natural gas.

U. S. executives interested in any branch of the oil and natural gas industry in Canada will find a useful ally, and a prompt, dependable source of information in The Canadian Bank of Commerce. Write or telegraph direct to C. H. Munro, Manager, Petroleum and Natural Gas Department, 309 Eighth Avenue, West, Calgary, Alberta, or to our Business Development Division, Head Office, Toronto 1, Canada.

(*We regret that we cannot advise on the merits of oil or mining securities*)

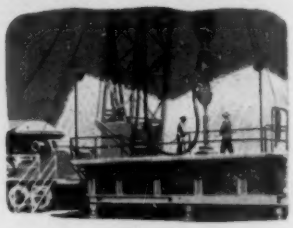
THE CANADIAN BANK OF COMMERCE

Head Office Toronto 1, Canada

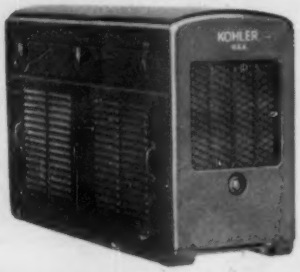
New York • San Francisco • Los Angeles • Seattle • Portland, Ore.
Resident Representative—Chicago and more than 750 branches across Canada

KOHLER ELECTRIC PLANTS

Complete line, gasoline and diesel, for all oil field applications



Model 5MH22, *5 KW, 115 volt AC, with housing, Liquid-cooled.*



Heavy-duty 5 KW model provides reliable power for rig lights, floodlights, maintenance tools—also mobile service on portable rigs. Operates with gasoline or natural gas. Engine is 4-cylinder water-cooled. Other sizes 500 watts to 50 KW. Diesel models, 10 KW to 50 KW for off-shore exploration, lighting and galley equipment on personnel boats, quarter boats, tugs, barges. Also automatic stand-by plants for refineries, tank farms. Write for folder 25-G.

Visit the Kohler exhibit at the Petroleum Industry Electrical Association Conference, Houston, Texas, April 16-18.

Kohler Co., Kohler, Wisconsin • Established 1873

Plumbing Fixtures • Heating Equipment • Electric Plants • Air-cooled Engines • Precision Controls

KOHLER OF KOHLER

GOT A SEPARATION PROBLEM?

READ THIS BOOKLET
LEARN HOW TO SEPARATE

✓ OIL AND LIGHTENDS FROM GAS
✓ CARRYOVER FROM VESSELS
✓ COMPRESSOR OIL AND CONDENSATE FROM GAS & VAPOR
✓ MOISTURE AND OIL FROM STEAM

If you have one of the above separation problems, write for Anderson's free purification booklet. Here you'll learn the most efficient method yet developed for separating mist, liquid, or particles from any gas or vapor. Anderson's purifiers, scrubbers, and mist extractors are absolutely maintenance free. There are no moving parts, filters or screens that require servicing. Results are guaranteed. Outline your problem to us today.

FREE PURIFICATION BOOKLET

The V. D. Anderson Company
division of International Basic Economy Corporation
1977 West 96th Street • Cleveland 2, Ohio
Please send your purification booklet without obligation.

Name_____
Company_____
Address_____
City_____ State_____

PURIFIERS • SCRUBBERS • SEPARATORS • MIST EXTRACTORS

energy radiation as an effective tool not only in the laboratory but also in the refinery as well as in petrochemical plants.

"Atomic radiation might prove selective enough to effect reactions unattainable with thermal energy."

by H. W. Field and Vincent J. Keenan

ATOMIC radiation is a promising new research tool for an industry long restricted to heat and catalysis in effecting the many chemical reactions encountered in petroleum processing. At our present level of knowledge, it may be somewhat premature to speculate as to whether this new technique will achieve a major role in refinery operation.

The conversion of atomic energy to heat or electricity or both, is already under intensive development. The direct application of radiation to petroleum chemistry has received far less attention. One major area needing investigation is in the supplemental use of atomic radiation to facilitate thermal and catalytic reactions. Under milder conditions, particularly at lower temperatures, we might minimize the wasteful side reactions which now handicap these techniques.

A second approach rests on the hope that atomic radiation might prove selective enough to effect reactions unattainable with thermal energy. This could lead to new types of petroleum products.

Our own research to date points to the paraffins as the most fruitful class. The aromatics seem capable of absorbing uneconomically large amounts of radiation without undergoing much change or "damage" as the nuclear physicist terms it. Chemically, the main effect of the radiation appears to be the rupture of carbon-hydrogen bonds. The resulting intermediate or "radical" is short lived. It may lose more hydrogen to form an olefin, or it may couple with other molecules to form dimeric, trimeric, and even higher products.

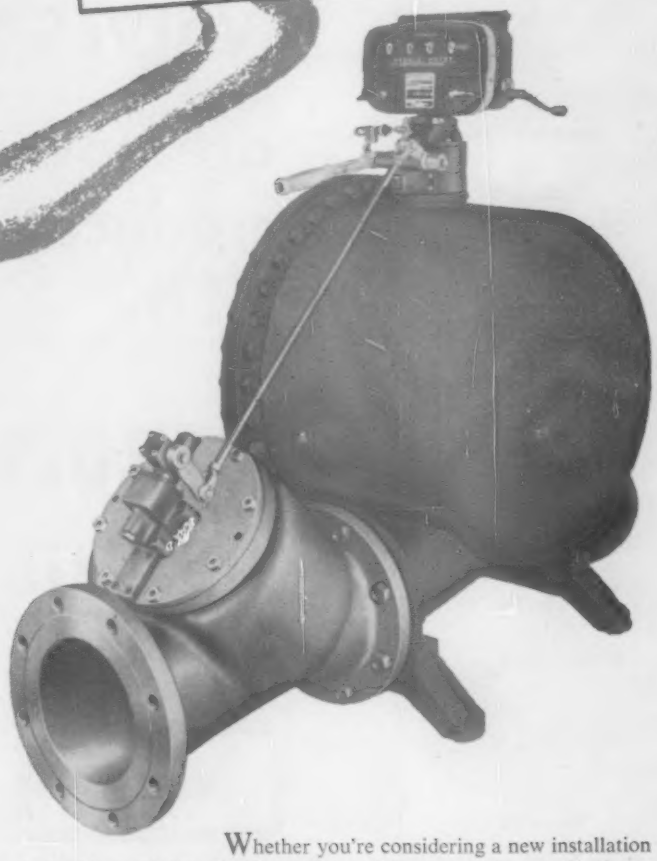
Thus our study of butane irradation has shown the formation of a mixture of hydrogen, butanes, octanes, octenes and some of the corresponding C_{12} hydrocarbons. Most encouraging is the minimal amount of carbon-carbon bond

The authors are, respectively, vice president, research and development department, Atlantic Refining Co., Philadelphia, and head chemical products section, research division, research and development department Atlantic Refining Co.

BRODIE *SHOCK-FREE* Quantrol® Shutoff

NOW in a full range of sizes and capacities

for 2″ to 8″ lines — 100 to 1,300 gpm
Working pressures to 150 psi



- For all new or existing *BiRotor* Meters
- Accurately measures quantity delivered
- Automatic meter operated volume shutoff
- Cushioned closing avoids shock damage

701

Whether you're considering a new installation — or converting existing Brodie *BiRotor* Meters to *Automatic Preset Quantity Control*—Brodie smooth *Shock-free Quantrol* shutoff now offers a full range of sizes and capacities. You gain safe, positive volume control that eliminates shock damage to piping, pumps and other equipment. Brodie *Quantrol* conversion kits permit quick easy change-over. When you specify, indicate *new* or *existing* meter installation requirements. Contact Brodie *first* for the last word in petroleum metering.

BRODIE BiRotor METERS

ALL-STEEL TRUE-ROTARY

RALPH N. BRODIE COMPANY • San Leandro, California, U.S.A.

MT. VERNON, N. Y. 550 So. Columbus Ave. | DALLAS 7, TEXAS 167 Parkhouse St. | CHICAGO OFFICE: 1227 Circle Ave., Forest Park, Ill. | SEATTLE 9, WASH. 221 9th Ave. N. | LOS ANGELES 22, CALIF. 5401 Sheila Street

REPRESENTATIVES WITH STOCKS AND SERVICE FACILITIES IN ALL PRINCIPAL CITIES

No. 107 Globe Valve

No. 1250 Gate Valve

No. 912 Globe Valve

No. 830 Stop Cock

No. 1296 Gas Cock

No. 840 Quick Operating Valve

DEPENDABLE

D.T. Williams VALVES

are now produced by

DETROIT CONTROLS

GUARDIANS OF THE PIPELINES
D.T. Williams VALVES

This new association serves only to assure users of D. T. Williams Valves continued high quality and good service in the future as in the past. Direct orders and correspondence to D. T. Williams Valves, Detroit Controls Corp., 5801 Mariemont Ave., Cincinnati 27, Ohio.

5900 Trumbull Avenue
Detroit 8, Michigan

DETROIT CONTROLS
CORPORATION
Division of American-Standard

rupture whch would lead to cracked or isomerized products.

Finally, our comparative study of radiation types has yet to uncover any very profound differences. Pragmatically, however, the electrons will penetrate only an inch or so of most liquid hydrocarbons; the helium ion (α-particle) and the hydrogen ion (proton) even less. This tends to favor γ-rays which have very high penetrating power, even through reactor walls. The safety shielding required is correspondingly greater of course, and industry is only now on the threshold of high-powered sources which will permit large-scale processing studies.

Competitive to these radiation sources is the atomic reactor itself. A dual-purpose power reactor for the refinery is conceivable in which the hydrocarbon is circulated through the reactor to absorb the now-wasted radiation and induce chemical transformations of the above mentioned types.

Perhaps more visionary today is a strictly chemical production reactor in which the radiation source is a self-sustaining nuclear-fission reaction maintained in intimate contact with the hydrocarbon stream. Such a reactor would be highly dependent on cheap fissionable fuel. The operation of such a reactor might presumably borrow from the petroleum industry's experience with solid catalysts, in both bed and fluidized form, to promote contact between the nuclear fuel and the liquid or gaseous hydrocarbons. Material help in this direction can be anticipated from experience with the homogeneous-type atomic reactors now under development.

"Field of research has barely been scratched."

by A. I. Snow

THE most easily investigated radiation-induced reactions and the ones on which much work has been done involve production of polymers such as polyethylene, in the absence of catalysis. Commercial applications in this area have the stiff competition of new, rapidly improving catalytic processes. Another well-investigated field is improvement of polymers such as polyethylene by irradiation. Improvements here include electrical properties and increased softening point. There are now some minor commercial applications in this field. Some initial screening type of research has been done on changes in viscosity and other proper-

The author is with Sinclair Research Laboratories, Inc., Harvey, Il.

ties due to irradiation of petroleum products such as lube stocks.

Considerably less work has been done, and little has been published, on petroleum-process investigations involving possible large-scale reactions such as hydrogenation, cracking, isomerization, dehydrogenation, and the like. There has been only some general speculation on the effects of radiation used in conjunction with catalytic processes. With dimensionally large sources such as the spent-fuel elements in use at Sinclair Research Laboratories, standard bench-scale equipment can be used for investigation of this type. Many radiation sources in current use allow only small volumes to be irradiated thus forcing the use of miniaturized or otherwise highly specialized equipment.

In analysis of products, standard techniques such as mass spectrometry, infrared, ultraviolet, etc., can be employed as well as the fast-developing, increasingly valuable vapor-phase chromatography techniques now coming into wide use.

Some petroleum radiation applications are known today which could possibly be used commercially if radiation sources were cheap enough but, as a general statement, it is our feeling that the field of research concerning petroleum process and product applications has barely been scratched. Much additional research needs to be performed before the bulk of possible commercial petroleum applications can be discovered and then realistically evaluated. The existence and almost continual announcement of new well-equipped research facilities in the petroleum industry in this field indicates that the commercial picture should become much clearer within about the next 5 to 10 years.

"We do not anticipate immediate and revolutionary changes in process industry."

by Blaine B. Wescott

ALTHOUGH nuclear technology has made great progress in the few years since its inception, it has yet to demonstrate its full potential. Nuclear power is not now, except in a few special cases, competitive with power from fossil fuels, and there have been few startling breakthroughs in the application of nuclear energy in the chemical field. It is, however, our firm conviction that, in the long run, ways will be found to utilize the tremendous

Author is executive vice president, Gulf Research & Development Co., Pittsburgh.

CORROSION

TYPE	HOW TO IDENTIFY
GALVANIC	Localized deep grooves or pits, often at contact between dissimilar metals.
UNIFORM	Uniform attack—may be on only one part.
INTERGRANULAR	Attack at grain boundaries.
PITTING	Rapid, deep pitting at several small areas. May be uniform or highly localized.

Why you can conquer all four kinds of corrosion with Goulds chemical pumps

When you buy Goulds Fig. 3715 chemical pumps you can build *specific* protection against all four types of corrosion.

Match the pump metal to your liquids. You can have the *entire* fluid end of the pump made of 316 stainless, Gould-A-Loy 20, nickel aluminum bronze, iron, iron with stainless trim or nickel aluminum bronze trim. These metals from stock. Any machinable alloy on application.

All machined parts in all metals held to same close clearances permitting economical alloy changes in the field . . . the entire liquid end or any component as conditions warrant.

Choosing from this wide range of metals, you can combat the different corrosive actions of hot acids, alkalies, slurries, sizes, or whatever other corrosive liquids you pump.

Match pump size to job

You can get Goulds Fig. 3715 in 9 sizes: capacities to 720 GPM, heads to 200 ft. Other features of Fig. 3715: water-jacketed support head permits handling liquids at 350°F.; impeller clearance can be adjusted without dismantling the pump. For more information, write for Bulletin 720.4.

These larger pumps also fight corrosion

For larger capacities or heads, you can get these other Goulds pumps in metals that resist specific corrosion:

Fig. 3405—single stage, double suction; 19 sizes; capacity to 6400 GPM, head to 425 ft. Bulletin 721.6. Popular sizes available in 316 stainless steel from stock.

Fig. 3305—two stage, opposed impellers; 8 sizes; capacity to 1200 GPM, head to 1000 ft. Bulletin 722.6.

Fig. 3189—single stage, open impeller; 11 sizes; capacity to 1080 GPM, head to 180 ft. Bulletin 720.4.

Goulds PUMPS INC.
Seneca Falls
New York

Branches: Atlanta • Boston
Chicago • Houston
New York • Philadelphia
Pittsburgh • Tulsa

West Coast Representative: Goulds Pumps Western, Portland, Ore.
In Canada: The A. R. Williams Machinery Co., Ltd. in all principal cities.

energy available in the nucleus of the atom.

Much publicity has been given to changes observed in the molecular structure of hydrocarbons under the influence of ionizing radiation. Examples are chain-breaking, cross-linking chlorination, dimerization, etc. In many cases, such as the production of C_7-C_8 compounds by irradiation of butane or isobutane, the quantity of product has been very limited.

Nevertheless, the prospect of producing new or valuable products or of reducing costs of present processes or products by ionizing radiation is considered very good and a considerable portion of our radiation research program will be directed along such lines. In this study we will naturally look first at reactions or processes that are thermodynamically favorable. Ionizing radiation may conceivably compete with catalysts either by accelerating reactions directly or by promoting catalytic activity.

Investigations of the possibilties for using radiation on a commercial scale are handicapped by the complexities of the systems involved and, at best, research in this field is tedious. Because of the tremendous energy associated with ionizing radiation compared with the energetics of chemical reactions, a great variety of primary processes is possible. Contrary to other fields, there is little backlog of information from accademic research.

Therefore, Gulf Research & Development Co. feels that it is necessary to carry out much of the required fundamental research and has initiated a program along this line. In the first stage of this program we are attempting to gain an understanding of the mechanism of the action of ionizing radiation by thoroughly studying the radiation chemistry of simple pure hydrocarbons. Following exposure of a sample to electrons from a Van de Graaff accelerator, complete analyses are made using every technique of modern analytical chemistry including mass spectrometry, gas partition chromatography, infrared and ultraviolet absorption, etc.

As our knowledge and experience grow, it will become possible to make predictions about more and more complicated systems and from this understanding we expect to be able to recognize exactly where the use of radiation will be of advantage to the petroleum industry.

Commercial application of a process will, of course, be dependent on the economics. Ionizing radiation is still an expensive means for producing a product. We do not anticipate immediate and revolutionary changes in the process industry through radiation.

"Practical value . . . only if radiation-induced reactions lead to a less-expensive product."

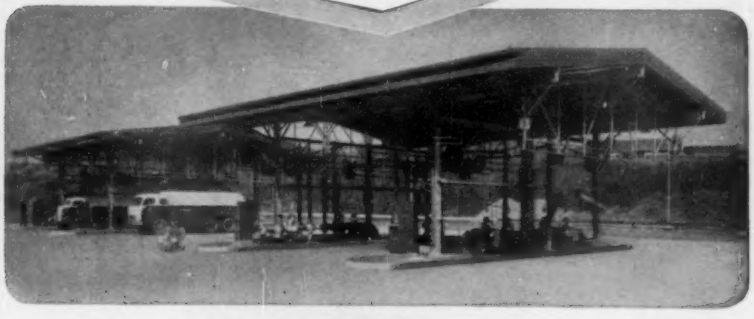
by Irving A. Berstein

THE practical value of radiation chemistry to the petroleum and chemical industries can be demonstrated only if radiation-induced reactions lead to a less-expensive product than that obtained from more conventional methods or to a new product of unique properties.

Excellent fundamental research has been under way in the complicated field of radiation chemistry for many years. Significant advances have been made in understanding some of the basic mechanisms though many important fundamental problems remain as formidable scientific challenges. More recently, investigations of an applied nature have been undertaken.

The author is head, chemistry department, Tracerlab, Inc.

ANOTHER NEW
Major Oil Company
Loading Rack in Action . . .



operating with OILCO
LONG-RANGE LOADER
No. 462

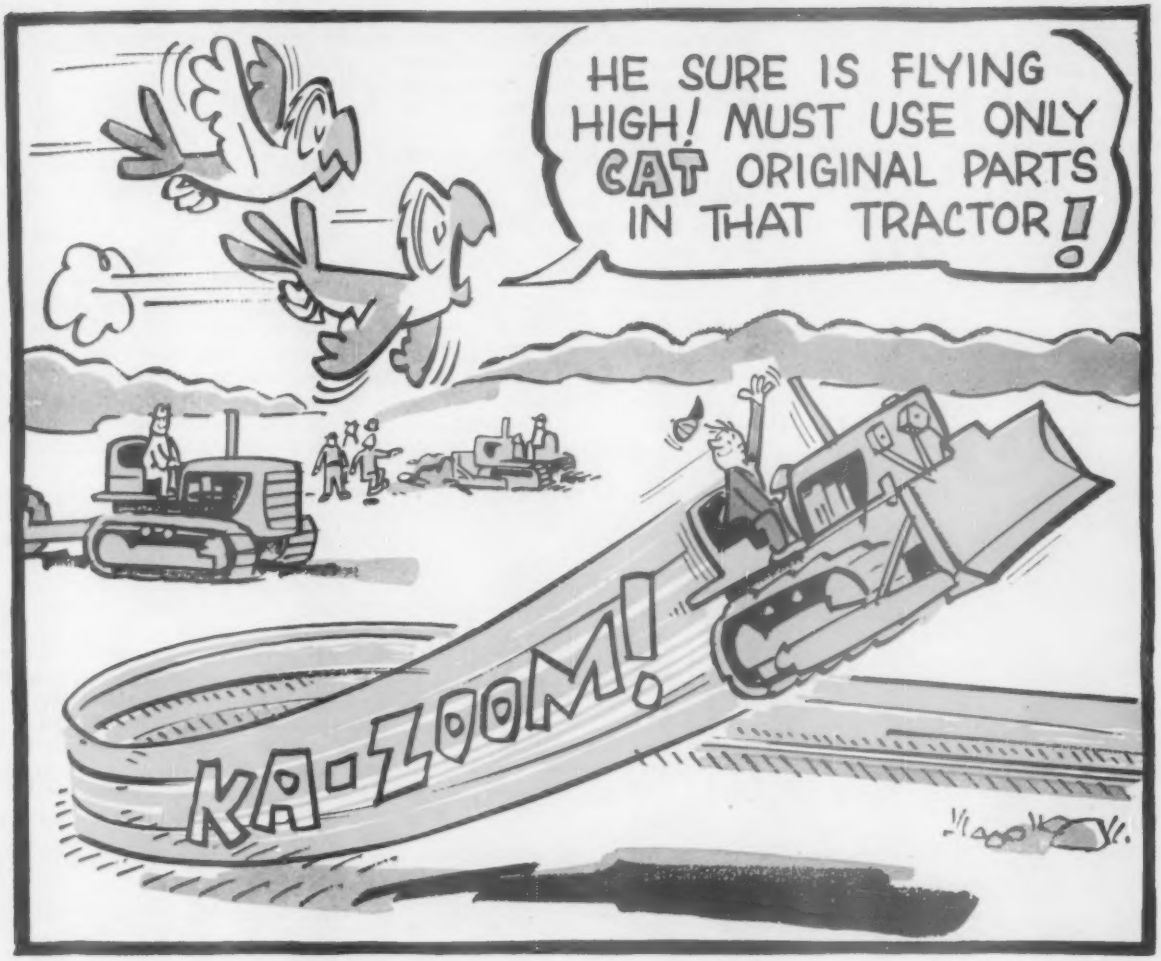
To meet the requirements of the industry—distributors, bulk plants and marketers—Oilco has perfected this assembly of extreme long range—a new loader which, without re-spotting, loads transports and tank cars in a jiffy. No intricate mechanism. It does its work quickly, easily and efficiently.

This Spring-Matic assembly includes No. 150 self-closing, shockproof loading line valve, and two Model 857 swing joints equipped with TIMKEN tapered roller bearings to insure positive alignment and greater friction-free load capacities.

The above illustration shows a new, modern installation employing 24 of these new Spring-Matic loaders on two racks, performing the job for which it was intended and doing it well.

Write for Folder A-7 for complete description

OIL EQUIPMENT MANUFACTURING CO.
INCORPORATED
3100 VERMONT AVE., LOUISVILLE 11, KY.



Are you aware of the **BIG THREE** in **CAT*** bellows seals for idlers, track rollers and final drive? You get special, long-lasting **FACING MATERIAL** . . . just the right amount of **CONTACT PRESSURE** at the mating surfaces . . . and **HEAVY DUTY DIAPHRAGMS** to resist bursting and tearing. Each **BIG THREE** feature was *developed* and *proved best* for Cat-built Tractors. If it's a "look-alike" seal, who knows? Be sure to get parts you can trust—from your Caterpillar Dealer. He always has *exactly* the part you need.

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

CATERPILLAR*

*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

RADIATION PROCESSING——

Again, appreciable success has already been obtained but many promising areas of study invite investigation.

All work performed thus far, both fundamental and applied, indicate that the detailed mechanisms of radiation-induced reactions of organic compounds are extremely complicated with a variety of unstable reactive species resulting from the interaction of radiation with matter, viz., activated molecules, activated ions, free electrons, and free radicals. These reactive species interact with neighboring molecules or decompose directly with the formation of free radicals.

Once the free radicals are formed, their reaction behavior is the same as free radicals generated from other energy sources or chemical initiators. The major difference, therefore, between radiation-initiated free radicals and those produced by other methods is that they can be formed at any temperature and pressure and that the rate of formation and their location in the reaction vessel can be controlled by the intensity and nature of the radiation source.

All reactions involving free radicals as intermediates proceed through three steps:

1. Formation of radicals.

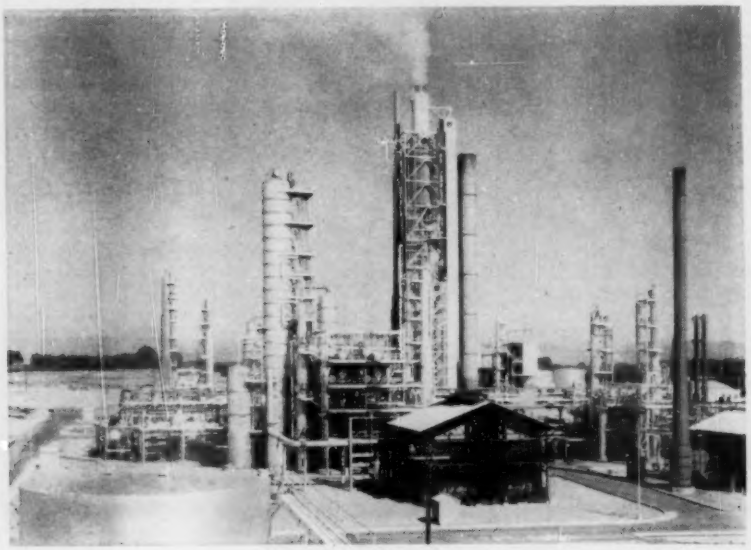
2. Propagation of a chain reaction (which may or may not be a long chain).

3. Termination of the chain by reaction of radicals with each other to form products.

Therefore, by controlling concentration of free radicals through the intensity of radiation impinging on the system, the kinetics and mechanism of the reaction can be affected and the nature of the product, e.g., its molecular weight and extent of cross-linking can be modified.

Important classes of reactions to study are therefore those reactions that are known to proceed through a radical mechanism or that might be induced to proceed through a radical mechanism if a high enough concentration of radicals could be generated. Examples of such reactions are halogenation, isomerization, oxygen oxidations, nitration, cracking of hydrocarbons, polymerization, copolymerization, grafting of monomers, and increasing cross-linking of polymers.

My personal feelings are that radiation chemical processing techniques should not be considered solely from the viewpoint of a competing method for the replacement of more conventional techniques of initiation of reactions. Rather, it seems that experimental investigations combining one of the more conventional methods—heat, light, generalized aicid-base catalysis, chemical radical iniators—**with** ionizing radiation should be thoroughly studied as well in the effort to attain the inherent advantages of both techniques.



This is the main processing area of General Petroleum Corporation's big refinery near Ferndale, Washington. The 35,000-barrel-a-day Mobilgas plant was the first full scale oil refinery built in the Pacific Northwest.

Partners in Petroleum

. . . to serve the expanding Pacific Northwest

Dependable, quality controlled chemicals assure greater refinery efficiency, increased production and aid in reducing costs. Numerous refineries throughout the United States and Canada are long-time users of PENNSALT quality controlled chemicals.

ANHYDROUS AMMONIA
•
ANHYDROUS HYDROFLUORIC ACID
•
CAUSTIC SODA
•
LIQUID CHLORINE

PENNSYLVANIA SALT MANUFACTURING COMPANY OF WASHINGTON
Tacoma, Washington

OFFICES AND TELEPHONES
Tacoma, MArket 9101 — Portland, CApitol 8-7655
Los Angeles, LUdlow 7-6244 — Philadelphia, LOcust 4-4700
Berkeley, AShberry 3-2537 — Vancouver, B. C., PAcific 7578

WESTERN DIVISION — Pennsylvania Salt Manufacturing Company

Pennsalt Chemicals

1850-1957

"First uses will likely be as reaction initiator."

by A. G. Oblad

LABORATORY studies of the use of radiation to produce chemical reactions in petroleum hydrocarbons have recently become fashionable. Many laboratories in the petroleum industry are presently engaged in studying such applications. As a result, we have seen in the press and in the technical literature optimistic statements regarding the potential of this new tool.

There is no doubt that uses will be found for radiation in the petroleum industry, but such uses, like any new development, initially will be for very special applications.

A realistic examination of this new tool shows that at present costs radiation will likely find first uses as a reaction initiator. That is, radiation will be used to induce reactions that are ener-

Author is with Houdry Process Corp., Philadelphia.

getically feasible. Radiation sources cost too much at present to be used as a source of energy for reactions that go uphill energywise and in which a low-value product is formed.

Reactions that take place by means of free radicals and having high efficiency in the formation of products molecules for each active species formed (reactions having long chain lengths) will be of most immediate interest. They will be followed by those reactions where only small chemical changes are required to produce a large change in the nature of a product or improve its specifications.

Examples of such reactions in the first class are polymerization and molecule splitting; while in the second class, such reactions are cross-linking of polymers, introduction of small amounts of a specific chemical into a product (inhibitors, stabilizers, etc.) and removal of traces of undesirable materials, such as trace metals, sulfur, nitrogen, oxygen.

Atomic energy as a heat source for chemical reactions is certainly technically feasible and will likely come into use when cost per B.t.u. approaches that of conventional fuels.

Like all new technological advances, use of radiation in the petroleum refining industry will develop slowly just as any other major advance has. It is now 20 years since catalysis made its debut as a major refining tool; only recently has it become the predominant technique in the refining picture.

"Present cost limits use of reactions to those in which a single ion affects a large number of atoms."

Discussion prepared by California Research Corp., Richmond, Calif.

THE processing of petroleum products with radiation from sources now at hand already shows promise along some lines. Present cost of radiation limits the use of reactions to those in which a single ion affects a large number of atoms.

One such type is a chain reaction which proceeds from one molecule to another after it is triggered. A common example of this is polymerization. Many new plastic polymers have been made experimentally with radiation. Likely some of these will have properties that will justify their being produced commercially. Chlorination is another type of reaction that proceeds in long chains; and this, too, offers possibilities in the radiation processing field.

A second kind of reaction that involves many atoms for each ion occurs in substances of high molecular weight. In food processing and fungus and insect control, this type of reaction is already close to commercial use. Cases may be found where present sources of radiation would modify petroleum products or chemicals in ecnomically feasible processes.

But the prospect of vast sources of cheap radiation seems to glow just beyond the horizon. If this prospect ever becomes a reality, oil refineries may take on a drastically different shape. High radiation levels can partly replace heat in the cracking process, and very intense radiation might replace the thermal process altogether.

California Research Corp., long a leader in the uses of radiation and radiotracers in refining problems, has accepted the challenge of radiation processing. In a new radiation laboratory, a 2-Mev Van de Graaff accelerator is at work in this new field of research. Every hopeful idea is checked. In a pasture so new and unfenced as this, no possibility is to be overlooked.

We venture to predict that some of these experimental irradiations will lead to commercially competitive processes very soon. Others will point to processes to be utilized in that future day when radiation becomes as cheap as heat.

STEARNS
GYROSPRAY®

On cooling towers and spray ponds, this head will produce an efficient and uniform spray at low pressure.

Self cleaning. Low cost. Long life. Let us tell you more. Write for data.
N. C. STEARNS CO.,
Box 1234, Shreveport, Louisiana

"... does things others can't!"

MERCOID®
WEATHER RESISTANT
CONTROLS

VISIBLE
CALIBRATED DIAL
ON-OFF SWITCH POSITION
OPERATING POINT INDICATORS

for pressure or temperature

HERMETICALLY SEALED CONTACT
ZINC PLATED STEEL CASE
OUTSIDE ADJUSTMENTS

FOR OUTDOOR SERVICE
OR OTHER APPLICATIONS
(NEMA 1A, 2, 3, 4)

Drip Tight
Semi-Dust Tight
Weather Resistant
(Weather Proof)
(Splash Proof)
(Sleet Proof)
(Moisture Resistant)
(Rain Tight)
Weather Tight
(Hose Test)

Write for catalog No. 857W which also lists general purpose controls (NEMA 1) and explosion proof controls (NEMA 7, 9, 9A).

THE MERCOID CORPORATION
4201 Belmont Ave., Chicago 41, Ill.

EVER-TITE The Best In Quick Couplings

EVER-TITE STANDARD ADAPTER AND COUPLER

EVER-TITE ADAPTER AND COUPLER

EVER-TITE SHANK HOSE COUPLING

EVER-TITE COUPLING ELBOW AND CHECK VALVE UNIT

Here is why EVER-TITE assures *speed... safety... economy*

Superior quality forged body —precision machined
Uniform wall thickness —no weak spots
Extra heavy reinforcing rim
Larger diameter cam ears for longer service life
Extra Hi-Strength forged handles —greater economy
Stainless Steel pins —greater safety and longer service
Uniform heavy wall thickness —no weak spots
Recess retains gasket in coupler and assures proper placement
Superior quality forged body —precision machined —accurate tolerances

You save time in deliveries — and reduce wear and maintenance costs—when you use Ever-Tite Couplings. Ever-Tite gives you the finest in *quality* and *engineering*. And Ever-Tite gives you *tight* connections every time — because every Ever-Tite has positive gasket compression that is dependable under *all* conditions. Get Ever-Tites — and get the best in quick couplings. There is an Ever-Tite for every need. Ask your distributor.

Brass • Stainless Steel
Aluminum • Malleable Iron
Other materials available on request

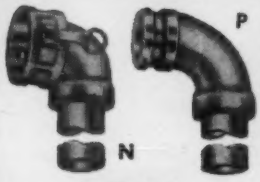
For Tight Fill Deliveries

EVER-TITE "99" COUPLER with Sight Gauge

No. 97 Ever-Tite Fill Cap

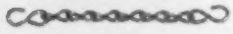
97 Adapters for Ever-Tite "99" Coupler

EVER-TITE ADAPTER AND COUPLER FOR TANK CAR UNLOADING

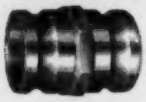


EVER-TITE 90° FULL-FLO ADAPTER AND COUPLER
Drop Tubes or Pipe Threads

EVER-TITE DUST PROTECTORS



Chain for attaching Dust Caps or Dust Plugs to adapters or couplers



EVER-TITE SPOOL ADAPTER

EVER-TITE GASKETS

EVER-TITE HANDLES

EVER-TITE COUPLING CO. INC., 254 WEST 54TH STREET, NEW YORK 19, N. Y.

Corrosion of Ferrous-Metal Tubing

Chromium and Nickel Confer Film Stability

by Thomas M. Krebs

EXAMINATION shows the superior resistance to pitting of the molybdenum-bearing Types 316 and 329 and the improvement obtained with higher chromium and nickel contents which confer film stability. It is interesting to observe that the GT-45 steel while containing about the same molybdenum content as Type 316 has lower pitting resistance in these tests.

A similar circumstance has been observed in the case of Type 347 which in general exhibits lower pitting resistance than Type 304 from the standpoint of pit frequency. In both cases the lowered pitting resistance is believed to be due to the inherent presence of columbium or titanium carbo-nitride inclusions in these alloys.

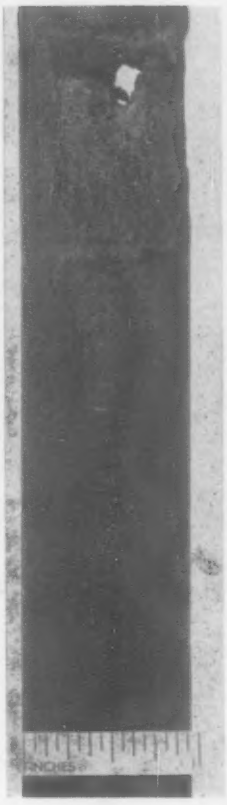
The inclusions serve as discontinuities in the surface film and exert a crevice or pit nucleating effect which serves to permit attack in environments conducive to this type of corrosion.

Crevice corrosion . . . Crevices such as exist at adjoining surfaces promote local corrosion within the opening. This so-called crevice corrosion may occur because of solution-concentration differences at the inside and outside of the crevice.

Contact between dissimilar metals in an electrolyte can also cause local accelerated attack through galvanic action. These effects are shown in Fig. 9 which shows electrolytic corrosion of carbon-steel tubing at a stainless-clad tube sheet resulting from an acidizing operation using hot 5 per cent hydrochloric acid to remove deposits from a vertical heat exchanger.

The cause of the attack was attributed to galvanic action between the dissimilar metals of tube and sheet together with crevice effects at the sheet-tube interface.

The author is metallurgist, Tubular Products Division, Babcock & Wilcox Co. Article presented at Western Petroleum Refiners Association meeting, Wichita.



GALVANIC and crevice corrosion of carbon-steel tube at a stainless-clad tube sheet. Fig. 9.

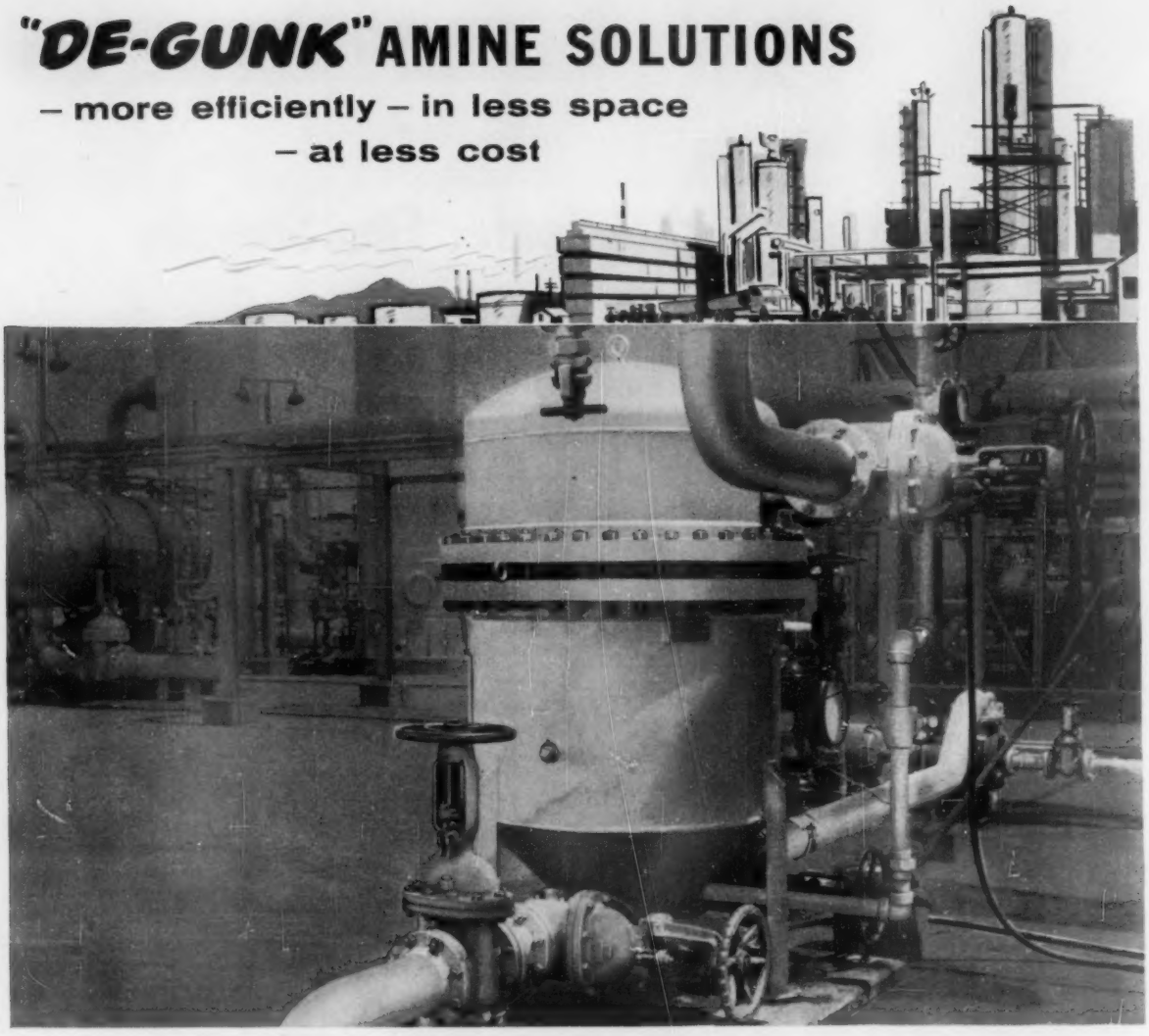
PITTING in a Type 304 tube used for cracking hydrocarbon gas at high temperature. Fig. 10.

Pitting also occurs at elevated temperatures although in these cases the mechanism is not electrochemical but like low-temperature pitting it is associated with nonuniformities in the environment or the metal surface. In gaseous hydrocarbon cracking units operating at elevated temperatures, nominally 1,500° F., pitting or even general wastage of chromium-nickel steels may occur in contact wth the gas stream.

These reactions appear to be associated with carburization followed by preferential oxidation of the chromium depleted areas and to this extent similar to the low-temperature intergranular corrosion previously described. The attack leads to dusting or grain separation and perhaps in some cases to metal loss through the formation of gaseous phases. Pitting in a Type 304 tube used in cracking hydrocarbon gas at 1,450° F. is shown in Fig. 10. Corrosion of this type may be controlled by the use of more resistant materials such as Croloy 25-20 or 18-8 Si together with proper adjustment of operating conditions in regard to charge components.

"DE-GUNK" AMINE SOLUTIONS

– more efficiently – in less space – at less cost



only STELLAR® FILTERS give you all these advantages –

1. Removal of finest solid corrosion products
2. Longest useful solution life
3. Maximum capacity in minimum space
4. Exclusive gas-bump cleaning eliminates backwashing, simplifies waste disposal
5. Shortest off-stream time for cleaning
6. Rugged corrosion-resistant construction
7. Simplicity of operation and maintenance
8. Flexibility of design pressure and size

These and other important advantages are inherent in the exclusive design and construction of the "STELLAR" filter. It offers you important savings in conservation of your Amine solutions, installation and operating costs, space and time. Write today for complete information and Bulletin No. 1560-B-OG-06.

Inquiries and samples are invited on all problems in the treatment of waters and wastes for the petroleum industry.

INFILCO

Centralize responsibility with INFILCO, THE ONLY COMPANY offering equipment for ALL types of water and waste processing — coagulation, precipitation, sedimentation, flotation, filtration, ion exchange and biological treatment

57403

INFILCO
INCORPORATED
General Offices • Tucson, Arizona • P.O. Box 5033
Field offices throughout the United States and in foreign countries

by J. L. Cottrell

REGULATORS, METERS, AND INTEGRATORS

Separator Pressure Should Be Constant

THIS field processing series deals with regulators, meters, and integrators used on field-gathering systems of gasoline plants. These devices are closely related in controlling the products recovered, with relation to the volume of gas handled through the plants.

1.—REGULATORS . . . The constant pressure on the separator is important and should be evenly controlled. Regulating and metering gas with entrained liquids is a far cry from dehydrated gas measured by gas-transmission companies. It often has a high sulfur content, flowing from wells that have been acidized, thereby adding to the woes of operations. In the plant, more care is taken to sizing regulators with relation to the rate of flow, however, in designing gatherings systems it is difficult to know the exact minimum and maximum rates of flow or operating pressures encountered. Therefore, a common procedure of sizing is to use a regulator of the same size as the line; for example, a 4-in. regulator on a 4-in. run.

On many field systems, the regulator is oversized. These are usually weight-and-lever or spring-loaded types of regulators. Some pilot regulators are used, but due to the kind of gas being controlled, pilot maintenance is a problem.

There are many arguments pro and con, between the weight-and-lever and the spring-loaded design, however, at pressures from 0 to 60 lb. the odds seem to be in favor of the spring regulator. Once the spring type of regulator is set for a given pressure and the adjustment screw is enclosed, it is less apt to be changed, whereas, the weight-and-lever regulator can be changed by the weight of birds, sleet, and curious people that may be on the lease.

Spring type of regulators . . . These have the same capacity for a given body and valve size as weight and lever regulators, when set for the desired pressure. Different springs can easily be changed for operating range, and set for the same degree of accuracy as the weights on the lever.

Author is with Flow Measurement Co., Inc., Tulsa. Paper presented at N.G.A.A. regional meeting at Shreveport, La.

The wear in the pens and the unbalanced effect of weight and lever often introduce operating problems. On some new regulators, the use of Teflon and synthetic O-rings have gone far to eliminate binds in the valve stem.

These back-pressure regulators usually operate in a range from inches of vacuum to 60 psi. To manufacturers they come under the category of low-pressure equipment, and therefore, are made of cast iron.

Valve design, port area, and area of the throat on the downstream side, removable seats, ease of servicing, etc., are being considered by designers. The use of O-rings on flanges and bottom plates are some of the new trends. Screw type of covers, instead of cap screws or studs, reduce the cost, as well as maintenance time in the field.

Regulating back pressure . . . The problem of back-pressure field regulation is a tough one from the standpoint of the operator as well as the manufacturer, for usually any given size of a back-pressure field regulator sells for less than a comparable size regulator used in other types of natural-gas service. Therefore, the manufacturer must cut manufacturing costs to a minimum and still have serviceable regulators, priced in line with competitor's in sizes 2, 3, 4, and 6 in.

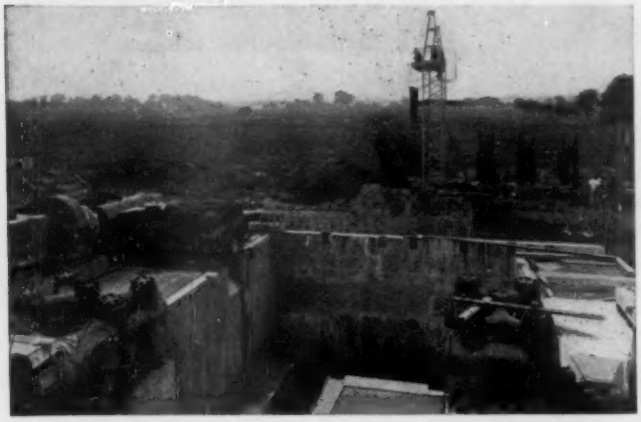
Engine pilot regulators . . . All of you are interested in even pressure on fuel to engines. There are a number of pilot regulators available for this service. Both single and double-valve design, are available on which outlet pressures can be varied in some cases, from inches of water to 150 psi. by simply changing the spring in the pilot regulator. Inlet pressures in cast-iron design range up to 400 psi., and on engine service, be guided by the manufacturers tables on capacities and don't necessarily select a regulator of the same size as the fuel line.

The distance of regulators ahead of the orifice plate on meter runs should be checked in accordance with A.G.A. specifications, and as straightening vanes are seldom used on field stations. If we consider the orifice to pipe diameter ratio—sometimes called the beta ratio at a maximum of 0.7—the regulator or pinch valve should be approximately 40 pipe diameters ahead of the orifice plate, when straightening vanes are not used.

2.—METERS (orifice meters) . . . The oil companies have more orifice meters in service than the gas companies on a national basis, for many gasoline plants have several hundred orifice meters on the gathering system, as compared to one master meter sometimes owned by the gas company to measure the residue sale into the pipeline.

Takes severe beating . . . The orifice meter is about the only type of meter that will take the severe beating in this type of measurement, as we are measuring wet gas, sometimes corrosive. Rates of flow often vary in the order of 10 to 1, and many times this change occurs 10 to 20 times within an hour. There have been many discussions as to the best differential range of meters, but on low-pressure field gathering systems, we like a 50-in. meter.

You have more capacity for a given size orifice than on a 20-in. meter, and stand a better chance of keeping the differential pen between the "goal posts" under these rapidly changing rates of flow. With the 50-in. differential range you can use 50-psi. pressure spring that may also be set for 30-in. vacuum 0-35 psi. by changing the chart and zeroing the pressure pen.



STATION CONSTRUCTION shows fluid ends of 8 by 20-in. duplex power pumps which will be driven by 450-hp. 480-volt electric motors through speed reducers.

DEEP CUTS were required to maintain a minimum 10 per cent grade for the 10-in. slurry line. Pipe was twice as thick as ordinary oil pipelines.

Opening a new frontier in transportation, world's first . . .

Coal pipeline moves slurry 110 miles

by Fred Culpepper
Ford, Bacon & Davis

THE transportation of solids by pipeline has long been an engineer's dream. As a matter of fact, a patent was issued in 1891 to a man named Andrews covering the conveyance of "solid matter in an artificial or even a natural condition of requisite fine division, introducing same into a liquid, conveying the mixture to a distance through pipes by gravity or force pumps." Andrews actually did experimental work with slurries and set up a working model at the Columbian World's Fair in Chicago in 1893 and was granted an award for this exhibit.

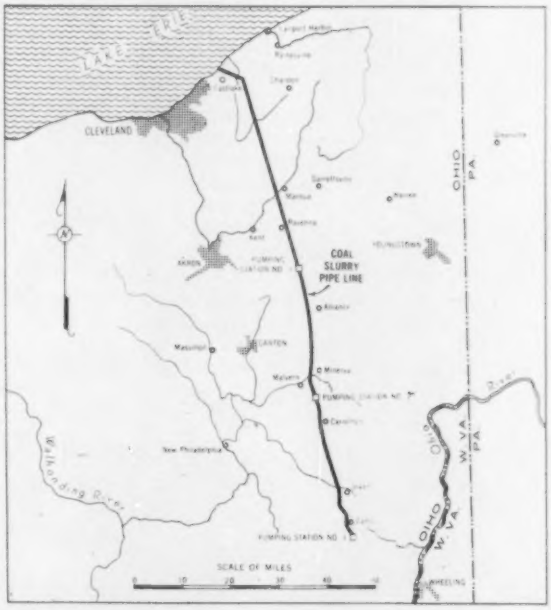
Research program . . . In 1949, Pittsburgh Consolidation Coal Co. started a research program pointed toward improving the competitive position of coal in the utility market. A program aimed toward increasing the efficiency of mining methods to the highest level in the industry was already well under way. The second avenue available for study was transportation. This was extremely important since studies proved that for hauls of 100 miles or more, freight represented 50 per cent of the cost.

It then became a matter of choice as to what method should be developed as an alternate means of transportation. Preliminary paper studies clearly indicated that a pipeline carrying a coal-water slurry offered appreciably greater potential savings over other possible modes of transportation.

It could be argued that since present coal-cleaning practices involve the making of a slurry, dewatering, and finally drying, the only effect of a pipeline would be to increase the distance between the slurry making and dewatering and drying step. Experience proved that the problem was somewhat more complex than it seemed. In fact, it took Pittsburgh Consolidation 6 years and some $2,000,000 to develop this idea.

Experiments . . . After considerable paper study of the problem it was decided that the known theories for this application were too empirical and ap-

Paper presented at 1957 Pipe Line Contractors Association convention, Boca Raton, Fla.



SYSTEM MAP shows the coal-slurry pipeline which starts at Cadiz, Ohio, and runs to the East Lake plant of Cleveland Electric Illuminating Co. on Lake Erie.

plicable only to the particular system from which the data were derived. Therefore, it was evident that if an operable pipeline with optimum economies was to be designed, some experimental work would have to be done.

Consequently, a pilot plant was constructed in May of 1950. This first installation consisted of a 1,000-gal. tank for slurry storage, a centrifugal pump for circulation, and a test loop of 200 ft. in length. The program was set up to determine influence of velocity, size consist, solids concentration, and pipe diameter upon pressure drop. The range of variables studied included:

1. Velocities from 1 to 20 ft. per second.
2. Size consists from ⅜ in. by 0 to 48 mesh by 0.
3. Concentrations from 0 to 60 weight per cent solids.
4. Pipe diameters of 2, 3, 4, and 6-in.

The initial plant data were encouraging although certain important questions were still unanswered. Some of these questions were:

1. Can you be sure that with appreciably longer lines the solids won't settle out as pump turbulence dies down?
2. What happens if you have an emergency shutdown, such as power failure, with the line full of slurry?
3. What would be the average life of the wearing parts on high pressure pumps?
4. Is it economically feasible to control corrosion by the use of an inhibitor?

Demonstration plant . . . In order to obtain answers to these questions it was decided to build a large-scale demonstration plant near the Georgetown preparation plant of the Hanna Coal Co. at Cadiz, Ohio. This plant was ready for operation by November of 1951. By the spring of 1953 major technical problems were resolved and data were available for defining the operating costs of a commercial coal pipeline.

Pittsburgh Consolidation Coal Co. then retained Ford, Bacon & Davis to make a feasibility study based on the data available from tests run in the demonstration plant. In May of 1954 this report was completed.

Feasibility report . . . The importance of the feasibility report must be emphasized. Although technical factors have been determined, certain other important elements can weigh heavily in the final determination of the economic feasibility of a given project. The factors of supply and demand must be trended to the anticipated construction period.

In the case of a pipeline the acquisition of right-of-way is becoming increasingly difficult and costly. Special consideration as to location is a part of this problem. Unique to a slurry pipeline is the problem of an adequate and economical water supply. The coal pipeline was based on a 15-year life, and the cost of operating the line during this time becomes an integral part of any feasibility study.

In August 1954 the decision was made to actually build a coal slurry pipeline between Cadiz, Ohio, and the Eastlake plant of Cleveland Electric Illuminating Co., a distance of about 110 miles. A contract was signed with the power company to supply 1,300,000 tons of coal per year for 15 years.

It was June of 1955 before actual acquisition of right-of-way for the pipeline was authorized. During the intervening period certain preliminary work such as location and survey was accomplished.

Pumping stations . . . In addition, design of the pumping stations was started. It was determined that three stations would be required: one at the preparation plant, a second approximately 30 miles north, the third and final station approximately 60 miles north. Basically, the three pumping stations were similar although certain control features were needed only at the No. 1 station.

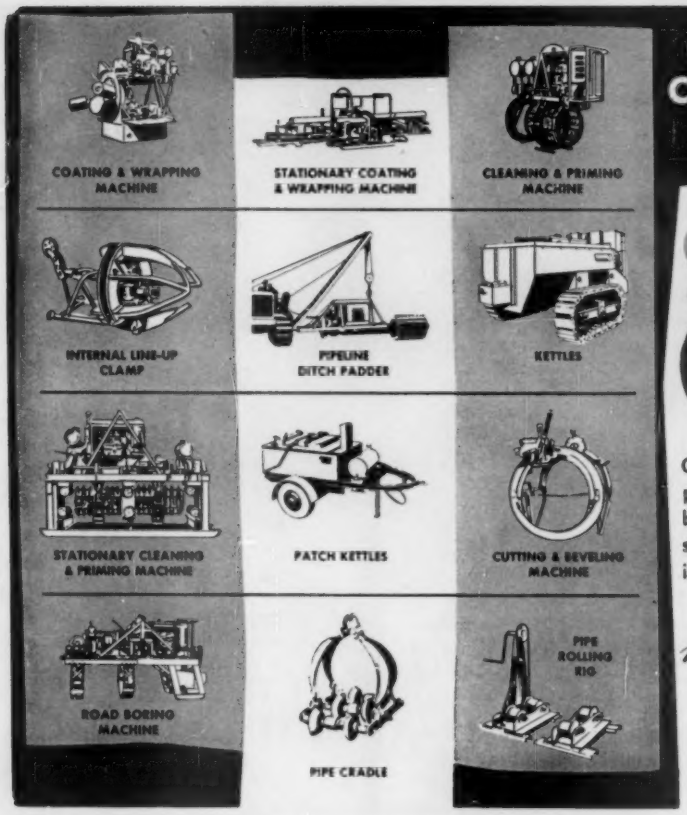
The main pumps are high-pressure, piston-type pumps driven by an electric motor. Two pumps will be operating with one on standby so that a routine maintenance schedule on replacement of the pump internals can be set up. The pump speed is automatically regulated to compensate for the wear of the internals.

In this way a constant throughput can be maintained as the volumetric efficiency decreases. When the efficiency of a pump reaches 80 per cent, it will be taken off stream and replaced by the standby. In addition, controls have been provided so that the preceding station will automatically pump through any booster station where a power failure might occur.

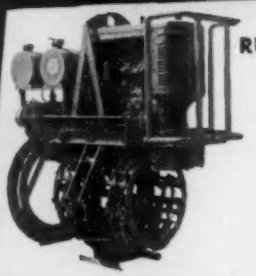
Feed preparation . . . The preparation plant at Cadiz, Ohio, was designed and built by Fairmont Machinery Co., a division of Pittsburgh Consolidation Coal Co. Clean ⅜-in. by 0 coal, which is a Deister Table product, is pumped as a slurry from the Georgetown cleaning plant to a set of screens in the slurry preparation plant.

For Fast
OUT-OF-STOCK SERVICE
VALVES AND FITTINGS
• KEROTEST Oilfield, Refinery and Pipeline Valves
• FAIRBANKS Iron and Bronze Valves
• OIC Forged Steel
• WELD & FLANGE Fittings
Inquiries for quotations appreciated.
Call or write . . .
VALVE ENGINEERING & SUPPLY COMPANY
Office & Warehouse
220 E. FIRST ST. • TULSA • CH 2-9989
GLENN DICKENSON—PRESIDENT

Write or Wire
for Monthly Stock Lists
● VALVES
● PRESSURE TUBING
● STEEL
Peerless Supply Co., Inc.
L. D. 75 & 76 P. O. Drawer 36-A
Shreveport, La.



CROSE LINE-TRAVELING CLEANING AND PRIMING MACHINE



RUGGEDLY BUILT YET LIGHT WEIGHT. Also can be used with stationary base for yard work. Handles pipe up to 36".

Counter rotating heads assure faster cleaning and priming . . . prevent pipe from turning and give better cleaning job. These Crose machines are specifically designed for faster, trouble-free service on the line.

M. J. Crose Manufacturing Company, Inc.

2715 DAWSON ROAD • TULSA, OKLAHOMA • PHONE MAdison 6-2172

New York, N. Y. Ph. Bllyan 9-2236 • *Denver, Colorado Ph. EMpire 6-0332
*Houston, Texas Ph. UNderwood 9-3358 • *Newark, N. J. Ph. MArket 4-3650
DISTRIBUTOR: *CROSE-CURRAN LTD. — EDMONTON, ALBERTA — PHONE 3-5135
*Warehouses in 4 locations

WHEN SPECS CALL FOR...

STEEL PLATE

custom fabricated on the West Coast

Save on transportation costs, manufacturing time and put yourself in a more competitive position by contacting an experienced "on the spot" source when planning the procurement of process and plant equipment for the West Coast. Send prints for prompt quotation on your next job.

Request Brochure No. G-57

PS F SINCE 1900 PUGET SOUND FABRICATORS, INC.
Craftsmen in Metals
3670 E. Marginal Way • Seattle 4, Wash.
Craftsmen in steel plate and alloys up to 1"

OIL MEN CALL US 'BANKERS'. . . but BANKERS CALL US 'OIL MEN'! ! !

You can talk the strange language of Oil with us because we "made up" some of the words! Fifteen of our directors are directly affiliated with the oil industry. We have one of the largest Oil Credit files in the nation; OIL LOAN service that includes oil-wise Trust Dept. counsel. See R. ELMO THOMPSON, R. OTIS McCLINTOCK, RUSSELL F. HUNT, WM. W. MICHAELS, BILL KENDALL or R. H. GWINNER. Remember, in Tulsa . . . in the Middle West . . . it's BOTH pleasant and profitable to . . .

Think 1st FIRST NATIONAL BANK & TRUST CO. *of Tulsa*

SINCE 1895

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

PIPELINE PATROL

The undersize from the screens, which is suitable pipeline feed, goes directly to drag tanks. The screen oversize is either crushed and sent to the same tanks or can be pumped directly to a storage pond. If it is crushed, the excess coal from the drag-tank discharge is sent to a second storage pond. The very fine coal that overflows with the water from the drag tanks is sent to a third storage pond. The reason for storing the size fractions separately is to avoid the size segregation which would occur if all fractions were sent into one pond. In this way the dragged solids and the fine solids can then be recombined in the same ratio as existed in the feed to the drag tanks.

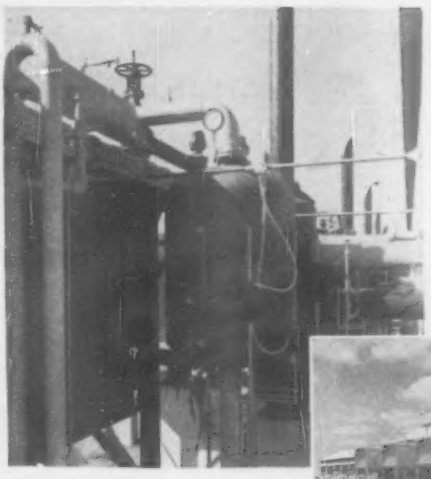
Also, the reduction of the screen oversize can be accomplished without overloading the crushers with fine coal. The final slurry is made up to the proper concentration by adding water to the pipeline solids in this tank. The tank is equipped with controls which continuously measure concentration and automatically add the proper amount of water. Thus, it can be seen that the greatest care has been taken to provide a pipeline feed of the proper size consist and solids concentration.

Dewatering . . . The dewatering plant at Eastlake was designed by Fairmont Machinery Co. and built by Merts Construction Co., of Cleveland. The pipeline slurry is discharged into two 90-ft. thickeners where it is thickened to about 60 weight per cent solids. The thickened slurry is then pumped to vacuum disk type of filters where the moisture content is reduced to around 20 per cent. The filter cake is charged into a storage bin. From the storage bin it is conveyed by belt into the regular fuel bunker of the power plant.

Both dry and wet type dust-collecting equipment have been installed to insure a clean discharge from the flash dryers. The final cleanup of the water prior to discharge is accomplished in an 85-ft. flocculator. It should be emphasized that in this plant, as in the slurry preparation plant, standard equipment common to coal-cleaning operations has been used.

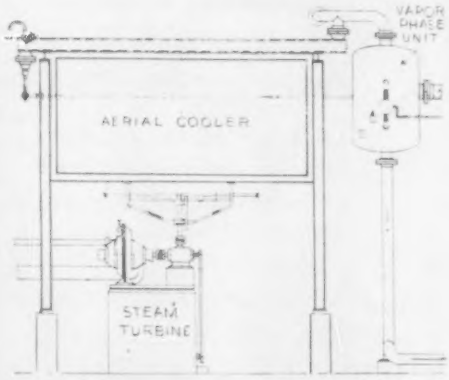
Slurry line future . . . It is obvious that the potential of this method of transporting solids is great. To date the surface has only been scratched. Possibly it would be well to quote the prediction of the judges at the Columbian Exposition in 1893 after viewing a model prepared by Andrews: "This method is destined ere long to become the carbon thoroughfare for the transportation of the motive power of the ages."

UNITED GAS PIPE LINE CONVERTS TO VAPOR PHASE



Eliminates Engine Power for Driving Turbine Fan . . . Utilizes Power Cylinder Waste Heat

In January, 1954, United Gas Pipe Line Company installed Vapor Phase Thermal Circulation on five 880-bhp gas engine compressors at their Agua Dulce, Texas, gas compressor station.



During September, 1956, one fan-drive was converted to the Vapor Phase Steam Turbine Fan Drive (utilizing power cylinder waste heat as steam at 15 p.s.i.g. pressure), thus eliminating engine power formerly required to drive the fan for lube oil cooling and steam condensing.

"Sole Developers and Manufacturers of Vapor Phase Thermal Circulation (Ebullition) Engine Cooling"

E C VAPOR PHASE

ENGINEERING CONTROLS Incorporated

AN AFFILIATE OF ST. LOUIS SHIPBUILDING & STEEL CO.

328 Paul Brown Bldg.
St. Louis 1, Mo.

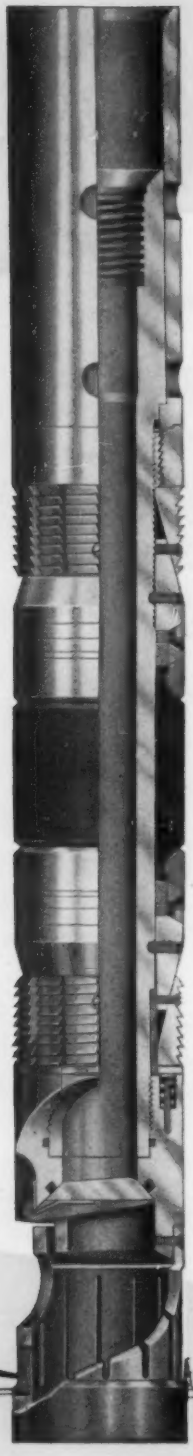
1939 N. Hillhurst Ave.
Los Angeles 27, Calif.

For Permanent-Type Well Completions

THE BAKER

RETAINER PRODUCTION PACKER

PRODUCT NO. 415D



BAKER PACKERS ADD PERMANENCE TO PERMANENT-TYPE WELL COMPLETIONS

When you select a Packer for a Permanent-Type Well Completion, remember this fact: of all the tools used in permanent-type well completions, only the *Packer* is required to be *permanent*. Guns, Extensions, Plugs, Gas-Lift and Circulating Valves can be removed or replaced on wire line . . . but the Packer, like the casing, is required to perform for the life of the selected producing intervals. Baker Packer Completions are Permanent Completions from the standpoint of packer performance.

Advantages of Baker Retainer Production Packer in Permanent-Type Well Completions:

PERMANENT, RELIABLE PACK-OFF will hold against any pressure differential from above or below that is safe for the casing.

FREE TUBING STRING . . . neither set-down tubing weight nor tubing tension required to achieve and maintain pack-off. Tubing can be anchored to Packer if desired.

CAN BE USED AS A SQUEEZE OR A PRODUCTION TOOL.

MEETS PERMANENT-TYPE WELL COMPLETION DIMENSIONAL REQUIREMENTS.

CAN BE SET ON WIRE LINE. PERMITS EASY REMOVAL OF TUBING STRING.

READILY DRILLABLE IN CASE OF EMERGENCY OR NEED.

BAKER OIL TOOLS, INC. HOUSTON • LOS ANGELES • NEW YORK

Among the

Drilling Contractors

Bell & Burden, Inc., Los Angeles, is getting under way on a projected 10,000-ft. wildcat test at Hasley Canyon, in Los Angeles County, California. It is a contract job for McCullough Oil Exploration Co. at 1 Seegram, in 4-4s-17w.

Rio Drilling Co. is contractor on a wildcat test Blair & Vreeland are drilling 5 miles west of St. Paul, in northern San Patricio County, South Texas. It is a 6,000-ft. test at 1-A Graham, in Section 6, Pauls Subdivision of the J. J. Welder Ranch.

Joe A. Payne Drilling Co., Corpus Christi, has a rig running for Delhi-Taylor Oil Corp. at a wildcat location ½ miles east of Oakville, in Live Oak County, South Texas. It is a 7,900-ft. contract operation. Location is at 1 Reagan, in the L. Lean Survey.

Clyde Hall Drilling Co., Bakersfield, Calif., has a rig working for Union Oil Co. on a deep extension test in the new Stenderup area, near Arvin, southeast of Bakersfield, in Kern County, California. The test is listed as Union-Hancock 53-21 Cattani. Spot is in 21-31-29. It is a 10,000-ft. contract. **Casey & Montgomery,** Bakersfield, also are drilling for the same operators in the Stenderup area. Their rig is on 77-27 Guimarra, in 27-31-29, about 2 miles southeast, at Mountain View.

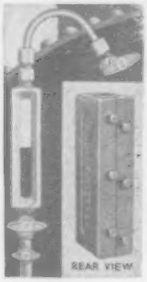
Rocky Mountain Drilling Co., Los Angeles, is scheduled for a 13,000-ft. test for Continental Oil Co. in the Paloma area, in Karnes County, California. Location is on a Kern County Land Co. lease in 8-32s-27e. It is about a mile southeast the Symons area, at Paloma.

J. E. Miller is contractor on another wildcat test L. G. Shelly and others have planned for their lease block located 8 to 8½ miles west of Ben Bolt, in Jim Wells County, South Texas. The new operation is at 1 Muil, in the Carl Hoffman Survey 72. It is a 6,500-ft. contract. The area is just east of the Duval County line.

Penrod Drilling Co., Shreveport, has a new deep operation 5 miles southwest of Emerson, in southern Columbia County, southern Arkansas. It is a contract job for its affiliate, Hunt Oil Co. Location, at 1 McDonald, in 1-20s-21w, is 1¼ miles north of Red Rock field, just north across the state

SAFETY RECORDS—Jack Starr (right), vice president of drilling operations, Falcon Seaboard Drilling Co., Tulsa, and Boone Smiley (left), division manager, Oklahoma City, give recognition to Cecil C. Hampton (center), driller, for going four consecutive years without a lost-time injury to himself or any member of his crew. The achievement sets a record for the company. His award was a gold wrist watch, presented at a company dinner given for him and his crew at Lindsay, Okla. Sharing in the safety honors were Chet Necessary, his tool pusher, and Marvin Wilson, Dallas McGuffin, Hugh Malicoat, and Bill Morrow, members of his crew. During the 4 years, his rig drilled for major companies in western Oklahoma, West Virginia, and North Texas, and now is back in Central Oklahoma.

Advantages of the INFERNO "Clamp Type" Reflex Gages



- Extra heavy glass—1" thick.
- Malleable iron clamps. Action is so applied that the force is spread over entire length of glass.
- No glass breakage due to tightening set screws unevenly.
- Glass may be changed in a fraction of the time required for conventional gages.

Write for Bulletin No. 34

THE INFERNO CO.
Box 1138A
115 RICOU St.
SHREVEPORT, LA.
INFERNO

SANDUSKY MAC-IRON OHIO
ESTAB. 1901

SPECTACLE BLINDS

SPADE BLINDS
SPACER RINGS

TEMPORARY STRAINERS

LINE STRAINERS

PIVOT FLANGES

Specialists to the Petro-Chemical Engineering Field . . . based on scope, quality and service. Equipment available from stock, or made to your exact requirements.

Write today for the new Mac-Iron Catalog A-7. Your request will receive immediate attention.

The Mack Iron Works Company
Warren and Water Sts. - Sandusky, Ohio

MAKE 'EM UP *tight*– BREAK 'EM OUT *easy*

'Bestolife Lead Seal Tool Joint and Casing Compound gives maximum joint make-up, for *tight* seals—and *easy* separation of parts, for faster handling without danger to joints. Standard of the oil country for over twenty-five years. Unconditionally guaranteed. Packed in 1¼, 5, 20 and 50 lb. containers. Sold by leading supply houses throughout the world.

line in Webster Parish, northern Louisiana. Plans call for drilling to 11,000 ft. for a Smackover formation, found productive at Red Rock. This is just north of the old shallow producing area at Haynesville.

International Drilling Co., Long Beach, Calif., is drilliing on a projected 9,500-ft. test in the new Bridge area of South Mountain field, at Santa Paula, in Central Ventura County, California. It is a contract job for Fergus & Bosworth, of Bakersfield, Calif., at 1 Oakridge, in 13-3n-21w.

Harkins Drilling Co. is contractor on a 9,000-ft. wildcat test Colorado Oil & Gas Corp. and Commonwealth Oil Co., of Houston, are starting about ½ mile east of LaWard, in southern Jackson County, Texas Gulf Coast. Location is at 1 Ranch, in the I&GN Survey 16.

Taylor Drilling Co., Houston, has a rig under contract to Texas Gas Exploration Corp. at Napoleonville, in Assumption Parish, southeastern Louisiana. It now is on 1 Clifton, in 44-12s-13e, a 6,500-ft. test.

Rush Drilling Co., Houston, is working on a 7,000-ft. contract off the west end of Gordon field, in southern Beauregard Parish, southwestern Louisiana. It is a Frio test, at 1 Gimnick, in 27-6s-10w, for Texas Oil & Gas Co.

Maxwell Herring Drilling Co. is starting another Rodessa well for Jack Frost and E. L. Howard in Cayuga field, Anderson County, East Texas. Location, at 1 Barton, in the A. J. Allen Survey, is 2½ miles north of Cayuga. Objective is at a depth of about 8,000 ft.

D & D Drilling Co., Casper, Wyo., has a new contract job in Fremont County, western Wyoming. It is for Sam Bailey at 1 Sun Tribal, in 21-7n-1w, about 7 miles northeast of Maverick Springs, in the northern part of the county.

Superior Drilling Co. and **Edwards & Bissett,** both of Houston, are the respective contractors on two wildcat operations being started on the Texas Gulf Coast by Trice Production Co. Superior's job is a 9,000-ft. test at 1 Schlumberger a mile north of Rosharon, in Brazoria County. It is a mile southwest of the Sandy Point area. Edwards & Bissett will drill 1 Stockton, an 8,000-ft. test, 7 miles north of Hungerford, in Wharton County. It is 1½ miles northwest of the North Hungerford gas area.

FABRI-VALVE

AMERICA'S FOREMOST FABRICATORS OF VALVES

PREFERRED FOR ECONOMICAL OPERATION ON ANY PIPE LINE

All across the nation more and more plants are saving time and money by specifying Fabri-Valve. Preferred for their performance and economical operation, Fabri-Valves are custom-made to your specifications. Available in stainless steel, monel, nickel or any combination to meet your need. Fabri-Valves cost less...weigh less... and, of course, are cheaper to ship and install. For the best in modern valves specify custom-made Fabri-Valves.

Write, Wire, Call for More Information or Estimates

TRADE MARK

FABRI-VALVE COMPANY OF AMERICA

2100 N. Albina Avenue, Portland 12, Oregon

FABRI-VALVE DISTRIBUTORS

CORDES BROTHERS	Wilmington, Calif.
CORDES BROTHERS	San Francisco, Calif.
DIESEL ENGINEERING CO.	Seattle, Wash.
FELKER BROTHERS	Marshfield, Wis.
THOS. W. MACKAY & SONS, LTD.	Vancouver, B. C.
SOUTHERN CORP.	Charleston, S. C.

So SIMPLE
We Can
Adapt It
to ANY
LIQUID LEVEL
CONTROL JOB
A sleeve, raised and lowered within a non-magnetic tube, attracts or releases an Alnico magnet attached to a mercury switch. Basically, this is Magnetrol.
MAGNETROL

AS DEPENDABLE AS MAGNETIC FORCE ITSELF

● No matter how specialized the liquid level control application, adapting Magnetrol to meet it presents no problem. Whether it's for high pressures, high temperatures, corrosive liquids or any other condition, a few "standard" modifications and the job is done! Operation is so simple no changes in basic design are needed. That's why Magnetrol "fits" practically any application — why "specials" are so often standard with us.

Because of the utter simplicity and dependability of its magnetic principle, Magnetrol has *infinite operating life.* There are no wearing parts to get out of order.

Magnetrols are available for controlling level changes from .0025-in. to 150-ft., with single or multi-stage switching. Our experienced engineering staff is at your service.

MAGNETROL, Inc.

WHY NOT MAIL THE COUPON — NOW

MAGNETROL, Inc., 2107 S. Marshall Blvd., Chicago 23, Illinois

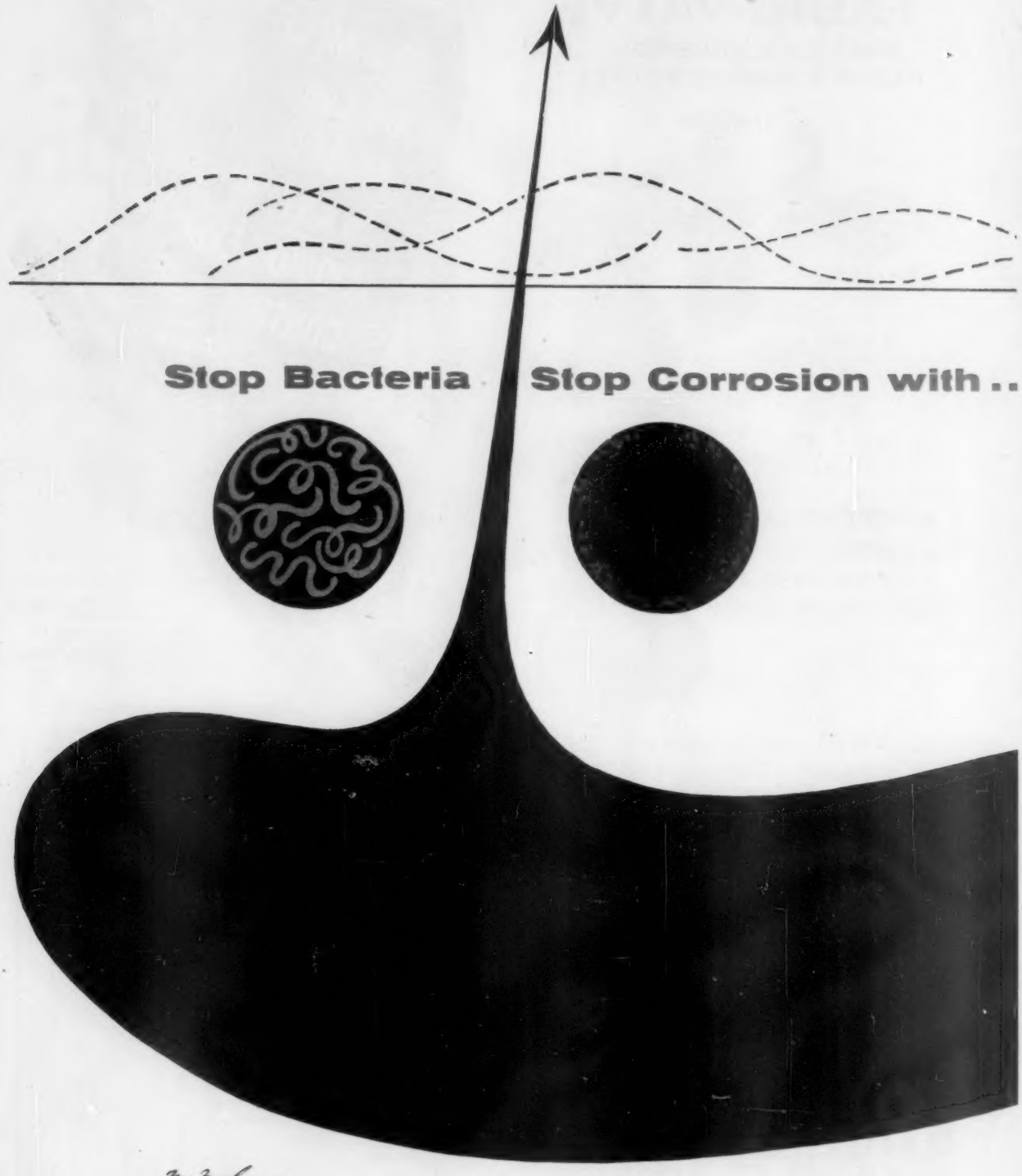
Please send me catalog data and full information on Magnetrol Liquid Level Controls.

Name_____

Company_____

Address_____

City_____ Zone____ State____


Stop Bacteria
Stop Corrosion with ..

Reports from engineers in the field show: Armour polar organic chemicals give 99.5% corrosion protection, and *complete* bacteria control—in concentrations as low as 6 ppm!

This remarkable record of success is a direct result of polar organic ability to be adsorbed continuously on metallic surfaces, forming a durable barrier against corrosive attack.

Equally important, they also adsorb on the surface of micro-organisms, disrupting the metabolic processes—particularly on the sulfate reducers, pseudomonas, iron and sulfur-forming types.

By using these Armour chemicals, your injection rates and pressures stay constant. Your equipment lasts longer.

Armour makes a series of polar organic inhibitors designed to solve specific problems. Look below for one to help you.

Armac® CD-50 (Distilled coco amine acetate salt, 50% active). A corrosion inhibitor-bactericide for water systems, this chemical has been proved effective in high brines or fresh water systems.

Duomeen® CD-50 (Distilled coco aliphatic diamine, 50% active). An extremely effective bactericide, but also an excellent corrosion inhibitor.

Duomeen CDA-50 (Distilled coco aliphatic diamine adipate salt, 50% active). An excellent bactericide and corrosion inhibitor that has found application in systems where carbon dioxide and oxygen corrosion are a problem.

Arquad® T-2C (Mixed monoalkyl and dialkyl quaternary ammonium chloride). A corrosion inhibitor and bactericide especially effective in low brines and fresh water systems.

Duomeen T (Tallow aliphatic diamine). An effective intermediate chemical for those who desire to formulate their own corrosion inhibitors or bactericides.

Duomeen TDO-50 (Liquid) (Tallow aliphatic diamine dioleate, 50% active). An easy to use, oil soluble, water dispersible down-the-hole corrosion inhibitor also being utilized to inhibit corrosion in salt water disposal systems and in producing wells.

Duomeen TDO (Fluid paste) (Tallow aliphatic diamine di-oleate). 100% active, oil soluble corrosion inhibitor.

Armour Chemicals Solve Refining Problems

Armour's line of polar cationic surface-active agents are being widely used in refineries to solve both operational and product problems.

The Armeens® and Duomeens® are typical of the Armour cationics that have resulted from laboratory and field evaluations. These materials and their derivatives are used in:

- *Controlling corrosion in processing equipment and finished product storage.*
- *Improving wear properties and acting as acid scavengers in lube oils.*
- *Inhibiting or solubilizing sludge formation in refinery products. . . . Stabilizing color . . . Improving filterability . . . Preventing fouling in equipment.*

For application information, product data, samples and treatment procedures, mail the coupon below.

NEW INFORMATION! HOW TO INCREASE PRIMARY AND SECONDARY OIL PRODUCTION! G3

- ☐ Send me booklet "Armour Organics For Increased Oil Production."
- ☐ Samples of _____ (fill in chemical desired)
- ☐ Application information on _____
- ☐ Treatment procedures for _____

Name _____ Title _____

Firm _____

Address _____

City _____ Zone _____ State _____

Armour Chemical Division • 1355 West 31st Street • Chicago 9, Ill.

.... **ARMOUR CHEMICALS FOR OIL PRODUCTION**

ARMOUR

Leader in Progressive Fatty Acid Chemistry

ARMOUR CHEMICAL DIVISION
©Armour and Company • Chicago 9, Illinois

. . . . Strike it rich!

Rich, indeed, are the dividends of satisfaction and performance you will obtain by specifying Wheatland Steel Pipe for every industrial purpose. In black or galvanized, Wheatland's matchless quality and unique year mark on every length are your guarantee of long, trouble free service.

API LINE PIPE IN ACCORDANCE WITH AMERICAN PETROLEUM INSTITUTE SPECIFICATIONS

WHEATLAND TUBE COMPANY

BANKERS SECURITIES BLDG., PHILA. 7, PA. MILLS • WHEATLAND, PA. • DELAIR, N. J.

Be sure with PURE

Producers • Refiners • Marketers

of petroleum products

THE PURE OIL COMPANY

Marketing Offices in Principal Cities of the Eastern, Central and Southern States
General Offices, Chicago, Illinois

This is Why the Nash is the Most Simple Compressor

It's the Nash!

There are no mechanical complications in a Nash Compressor. A single moving element, a round rotor, with shrouded blades, forming a series of buckets, revolves freely in an elliptical casing containing any low viscosity liquid. This liquid, carried with the rotor, follows the elliptical contour of the casing.

The moving liquid therefore recedes from the rotor buckets at the wide part of the ellipse, permitting the buckets to fill with gas from the stationary Inlet Ports. As the casing narrows, the liquid is forced back into the rotor buckets, compressing the gas, and delivering it through the fixed Outlet Ports.

Nash Compressors produce 75 lbs pressure in a single stage, with capacities to 6 million cu. ft per day in a single structure. Since compression is secured by an entirely different principle, gas pumping problems difficult with ordinary pumps are often handled easily in a Nash.

Nash simplicity means low maintenance cost, with original pump performance constant over long periods Data on these pumps sent immediately on request

No internal wearing parts.

No valves, pistons, or vanes.

No internal lubrication.

Low maintenance cost.

Saves floor space.

Desired delivery temperature automatically maintained.

Slugs of liquid entering pump will do no harm.

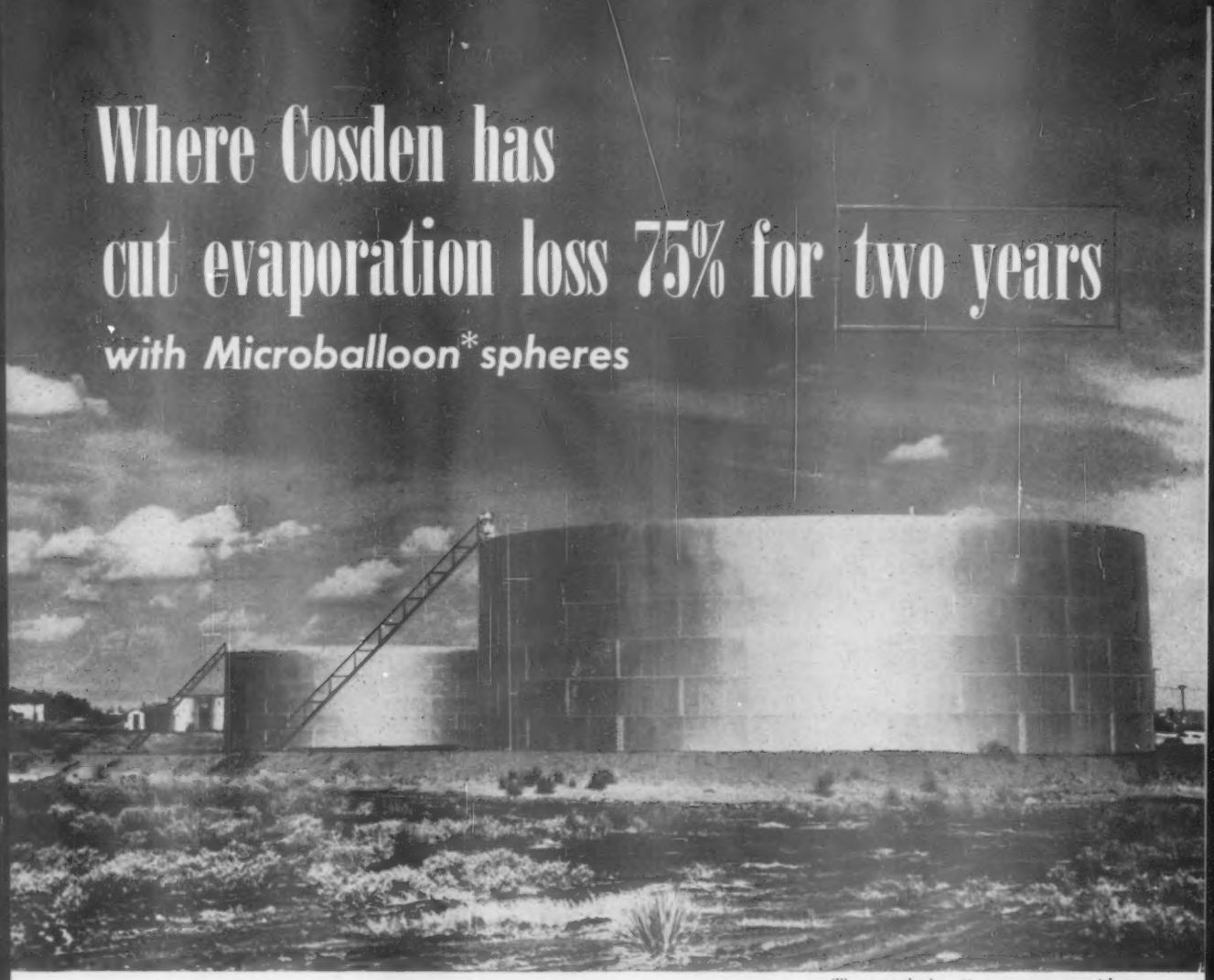
75 pounds in a single stage.

NASH ENGINEERING COMPANY

313 WILSON, SO. NORWALK, CONN.

Where Cosden has cut evaporation loss 75% for two years

with Microballoon* spheres



These tanks handle sweet crude with a high gravity—about 37 to 45 API—while gasoline content is 40 to 50 per cent. Approximately 1,500,000 bbl. per year have been pumped through each since the "Microballoon" spheres were installed.

In April, 1954, these 80,000-bbl. cone-roofed tanks owned by Cosden Petroleum Corp., Big Spring, Texas, were given a vapor-stopping seal of "Microballoon" spheres made from BAKELITE Brand Phenolic Resins.

Each tank was equipped with 4500 pounds of the spheres, which formed a foam seal on the oil surface. *After two years, this floating blanket is still effective.*

In that time, Cosden estimates it has reduced evaporation loss 75 per cent.

To learn more about this method of controlling evaporation, write, today to Department WD-128.

For evaporation control...

BAKELITE BRAND RESINS

*Registered trade-mark of The Standard Oil Co. (Ohio)

BAKELITE COMPANY, *A Division of Union Carbide and Carbon Corporation* UCC 30 East 42nd Street, New York 17, N. Y.

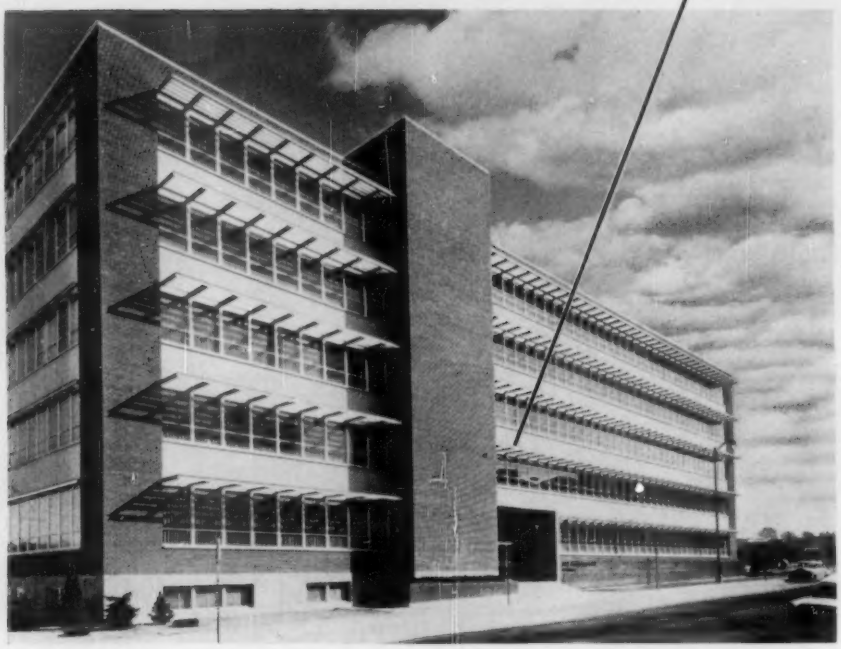
In Canada: Bakelite Company, Division of Union Carbide Canada Limited, Belleville, Ontario

The term BAKELITE and the Trefoil Symbol are registered trade-marks of UCC.

OPPORTUNITIES IN ENGINEERING

DENVER

For qualified engineers who would like to live in Denver and build a career



OUR CENTRAL ENGINEERING OFFICE

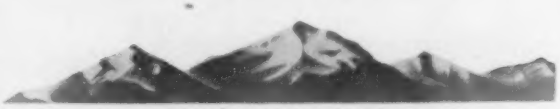
PROJECT – PROCESS ENGINEERS, DESIGNERS, DRAFTSMEN Experienced in Smelter & Mill Layout, Process Piping, Materials Handling, Structural Design, Electrical Design.

- Stearns-Roger is one of the largest and most progressive engineering and construction firms in the west. Current turnkey projects include: Smelters, Cement Plants, Concentrators, Gasoline Plants, Oil Refineries, Potash Plants, Rare Metal Mills, Chemical Plants and Power Plants.
- Ideal working conditions, liberal company benefits, and good salaries.
- Denver is internationally famous as a vacation spot. Ideal climate, over 300 days of sunshine, only 20 miles to the Rockies — trout fishing, hunting, skiing.

Address Director of Personnel

Stearns-Roger

P. O. Box 5370 Terminal Annex
660 Bannock St., Denver 17, Colo.



ESTABLISHED 1885

Alumalife® Case

Phenol Case

Why do ASHCROFT DURAGAUGE **CASES** increase service life?

Duragauge casings add extra-long service life to Duragauges because they're available in three different materials: you can choose the case-material that stands up best in *your application*. You have a choice of *Alumalife*® – a special aluminum alloy; *Cast Iron*, rugged and durable; and *Phenol*, a tough, rigid plastic.

Duragauge casings are dust and moistureproof. Chrome-plated, die-cast retaining rings keep the dial cover glass tightly in position and prevent the entrance of dirt or harmful fumes. Depending upon material, casings are Bonderized and the ring is Anodized and dichromate sealed for protection from corrosion.

For added protection, there is the Maxisafe Duragauge casing with a solid front – a special design for maximum safety and ease of maintenance. Duragauges are easy to service since Duragauge casings are constructed so that the entire system – socket, tube, tip, movement, dial and pointer – can easily be removed as a unit.

Lifetime Duragauge cases are available for numerous dial sizes. You have a choice of Bourdon tube materials, a wide range of pressures, and a movement made completely of stainless steel or stainless steel with nylon bearings and pinion gear.

Whatever case material and gauge system is best for your needs, you can rely on the Ashcroft Duragauge for highest sustained accuracy and long service life.

FOR PROMPT ASSISTANCE in selecting the right Ashcroft Duragauges for your specific needs, depend on the experience of your Industrial Supply Distributor. He is as close as your telephone.

In Canada: *Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario*

ASHCROFT GAUGES

A product of **MANNING, MAXWELL & MOORE, INC.** STRATFORD, CONNECTICUT

MAKERS OF 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'ASHCROFT' GAUGES, 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN-MICROSEN' INDUSTRIAL ELECTRONIC INSTRUMENTS, *Stratford, Conn.* 'HANCOCK' VALVES, *Watertown, Mass.* 'CONSOLIDATED' SAFETY RELIEF VALVES, *Tulsa, Okla.* AIRCRAFT CONTROL PRODUCTS, *Danbury & Stratford, Conn. and Inglewood, Calif.* "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES, *Muskegon, Mich.*

G4-56

exhaustive tests prove:

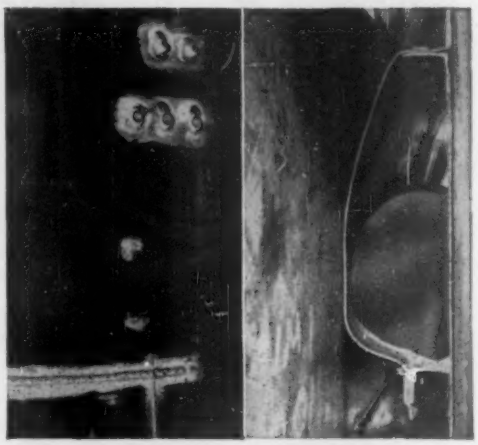
36 YEARS FROM TODAY

TUBESEALS* NOW IN FLOATING ROOF TANKS WILL OPERATE AS EFFICIENTLY AS THEY DO TODAY!

WE DOUBT this can be claimed for any other floating roof seal!

To determine the efficient life-expectancy of the Hammond Tubeseal in service, tests were made under the worst possible conditions to which a floating roof seal can be subjected. The Tubeseal was moved across very rough rivet heads, erection burrs and abrasive weld surfaces, for a total travel of 70,000 feet. This is equivalent to a normal wear of *more than 36 years in actual service.* Moreover, as the tests were run dry, there was the added disadvantage of the absence of lubricating effect normally created by wetted surfaces. Upon completion of these rigorous tests, the scuff band had only worn through the ribs and had barely penetrated through the material, leaving two-thirds of the stock intact; proof that the Tubeseal is unimpaired after traveling 70,000 feet.

The 36 year life-expectancy of a Hammond Tubeseal assumes no mechanical accident and is arrived at in the following manner: Each year a floating roof, in normal service, makes about 48 trips to and from top and bottom of tank. The roof of a 40 foot tank, therefore, will travel 1920 feet per year. Assuming 1920 feet of travel per year (based upon full depth of travel) and applying our accelerated wear test, the Tubeseal will be serviceable for at least 36 years 5½ months.



THE TUBESEAL TEST:

total travel	70,000 feet
travel over vertical weld	46,400 feet (on same line)
Horizontal welded seam crossed	21,200 times
Flat head rivets crossed	63,600 times

CONDITION OF TUBESEAL AFTER TEST: Scuff band had worn through ribs and had barely penetrated into the main material, leaving ⅔ of stock intact.

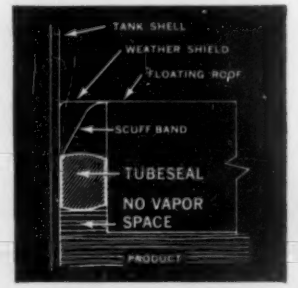
Tests were conducted dry with no aid of lubricant normally resulting from stored product.

Photos show projections used for test. Included are 16" of ¾" horizontal weld—24" of sharp, irregular vertical weld—2 erection burrs—3 ¾" flat head rivets and 2 ¾" cone head rivets.

THE HAMMOND TUBESEAL
is the most efficient and positive seal known.

it features:

no moving parts
no mechanical maintenance
climate proof
non-corrodible
can operate to bottom of tank or above the top
no vapor space below the seal
entire circumference has tight seal under pressure at all times
longer working life expectancy



NO ROOM FOR VAPORS
NO EVAPORATION
NO CORROSION

**patented* *Write for bulletin TS*

HAMMOND TUBESEAL — THE MOST EFFICIENT AND POSITIVE SEAL KNOWN

HAMMOND IRON WORKS

WARREN and BRISTOL, PA. • PROVO, UTAH • CASPER, WYO. • BIRMINGHAM, ALA.

Sales Offices:

BOSTON 10, MASS. • NEW YORK 20, N. Y. • CINCINNATI 2, OHIO • CHICAGO 3, ILL. • WARREN, PA. BRISTOL, PA. • ARLINGTON, VA. • GREENVILLE, S. C. • BIRMINGHAM, ALA. • SAGINAW, MICH. SAPULPA, OKLA. • PROVO, UTAH • CASPER, WYO. • LOS ANGELES 57, CALIF. • HAVANA • MEXICO CITY "TIPSA," BUENOS AIRES • CAIRO, EGYPT • PORT-AU-PRINCE, HAITI • LIMA, PERU

Licensees: CALIFORNIA, CANADA, ENGLAND, BELGIUM, GERMANY, ITALY, FRANCE, JAPAN

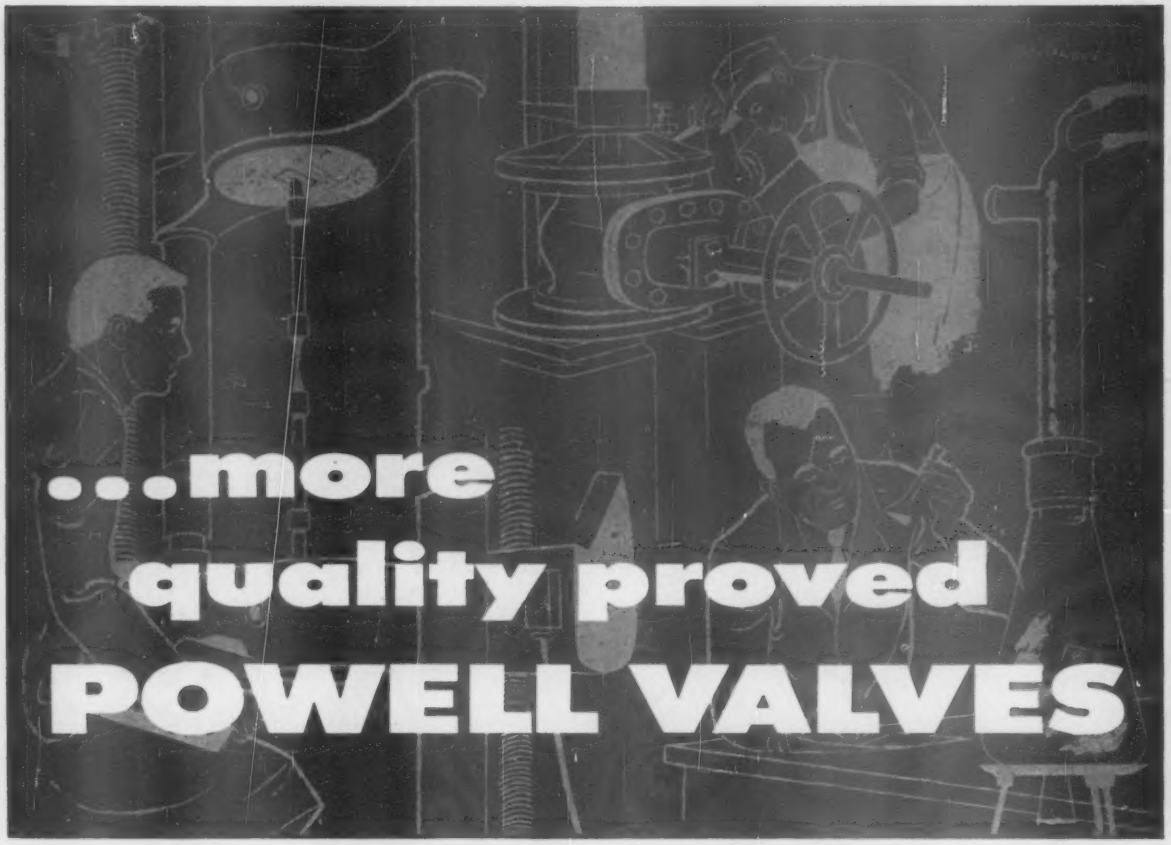
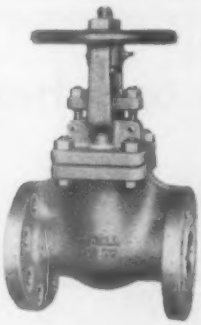


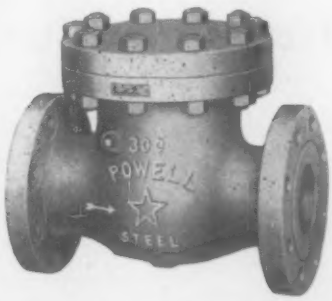
FIG. 375—Bronze "White Star" Gate Valve for 200 pounds W.S.P.

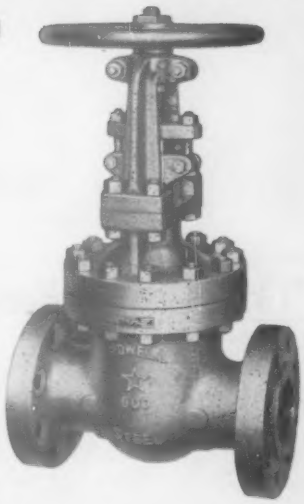
FIG. 2467—Stainless steel O.S. & Y. Gate Valve for 300 pounds W.P.

FIG. 6003—600-pound Steel O.S. & Y. Gate Valve

FIG. 3061—300-pound Steel Swing Check Valve



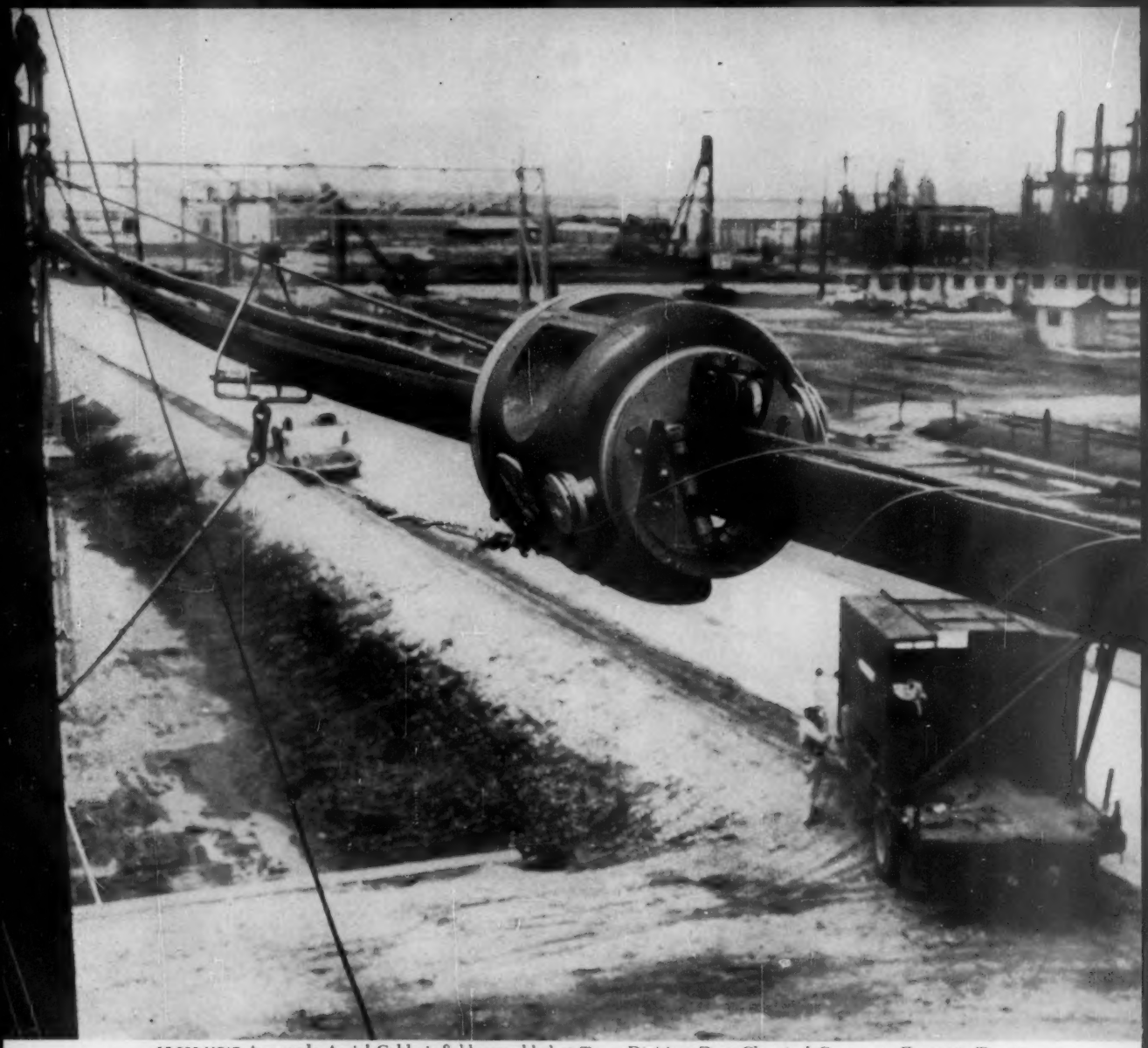




for dependable flow control

Consult your Powell Valve distributor for full facts about quality proved bronze, iron, steel and corrosion-resistant valves. For every flow control problem—there is a Powell Valve to solve it.

THE WM. POWELL COMPANY, CINCINNATI 22, OHIO . . . 111th YEAR



15,000 VOLT Anaconda Aerial Cable is field-assembled at Texas Division, Dow Chemical Company, Freeport, Texas.

This overhead cable reduces overhead costs!

Down time and repairs are costly—when storms knock out ordinary overhead lines. The answer is Anaconda Aerial Cable. This strong, sturdy cable gives peak protection against wind, snow, rain or sleet damage . . . offers *dependability and long-term economy!*

Aerial cable is easy to handle during installation—easy to splice, tap and terminate.

And, in plants where underground pipes or structures make installation of ducts or buried cable impossible or difficult, Anaconda Aerial Cable is ideal.

Neoprene jacket resists weather and abrasion. Special Anaconda Type AB butyl rubber high-voltage insulation gives extra protection against ozone, heat, moisture and fumes.

Ask the Man from Anaconda for full information on Anaconda's three types of Aerial Cable: 1) factory-assembled, 2) field-assembled, and 3) reverse-lay for easy tapping. Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.

57337

SEE THE MAN FROM ANACONDA®
FOR AERIAL CABLE

Even in oil...

GOOD THINGS CAN COME IN SMALL PACKAGES

The refinery shown below is certainly not one of the largest in the world. Perhaps, at a capacity of 700 bbls. per day, it is one of the smallest. Yet, using a UOP developed and licensed process, Platforming, this plant is producing profitably gasoline testing approximately 98 leaded Research octane number from natural gas concentrates. And this is being done right at the well head! It is operated by the South Hampton Company, near Silsbee, Texas.

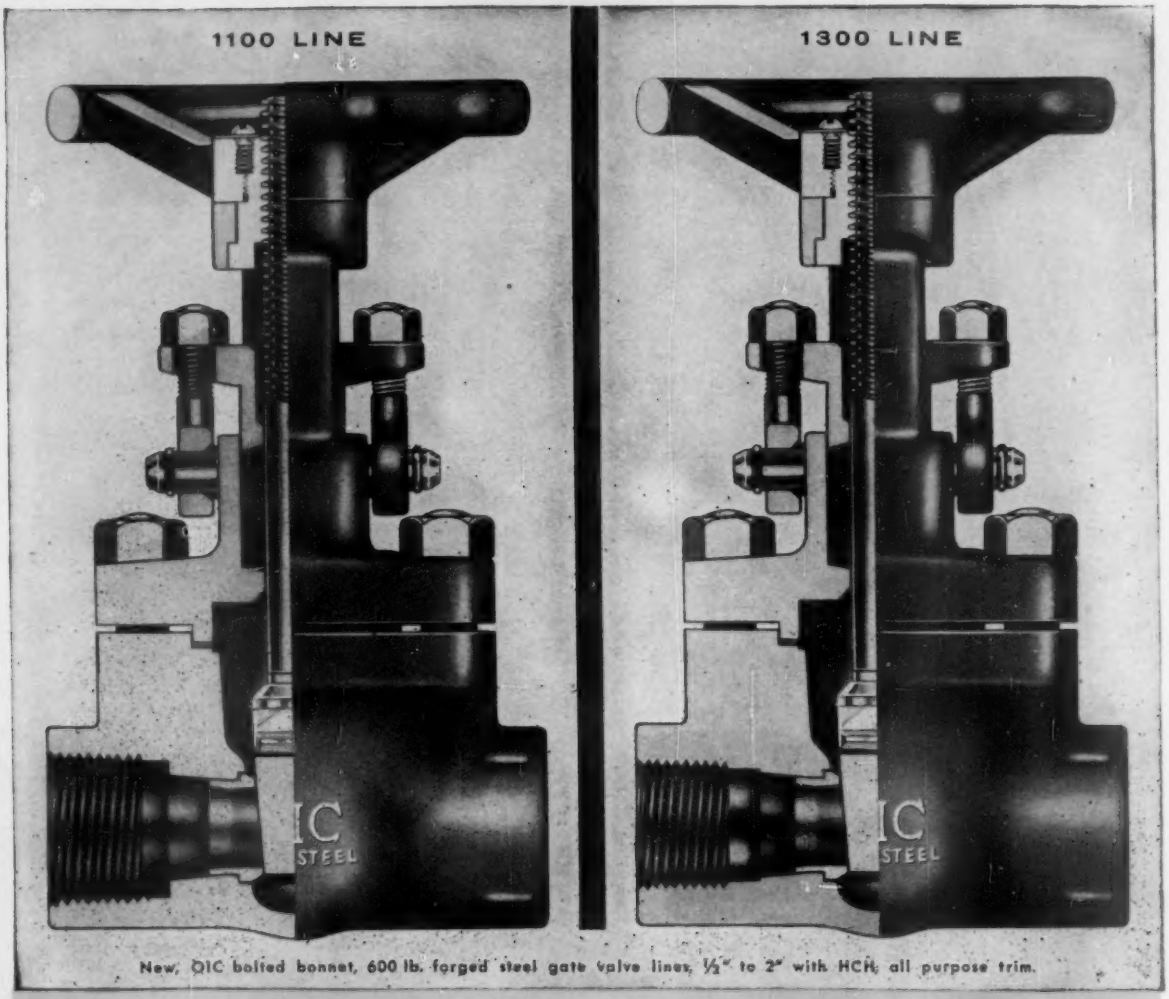
This unique operation is striking evidence of the capability of petroleum technology research to provide the methods by which refiners, regardless of plant capacity or market scope, can successfully manufacture and profitably market, the finest quality product in a highly competitive field.

For some forty years UOP has been developing and licensing petroleum refining processes and making them available to all refiners, everywhere. In cooperation with the technological and manufacturing staffs of UOP licensees the application of these processes has made a major contribution to the continuing betterment and marketability of petroleum products.

UOP UNIVERSAL OIL PRODUCTS COMPANY

30 Algonquin Road, Des Plaines, Illinois, U.S.A.

Forty Years Of Leadership In Petroleum Refining Technology



New, OIC bolted bonnet, 600 lb. forged steel gate valve lines, ½" to 2" with HCH, all purpose trim.

2 new rugged OIC forged steel lines

Both feature the modern and rugged bolted bonnet joint, which simplifies and lowers the cost of maintenance.

Both feature a soft iron gasket securely retained in the bolted male and female body-bonnet connection to assure enduring tightness.

Both feature 13% chrome stainless steel trim with 1000 Brinell, duracased wedges.

Both feature plenty of gripping area for pipe wrenches on pipe ends; there's no interference with body-bonnet flanges. Simplifies joint make-up!

The 1300 line includes a *high flow* port area, offering full-flow characteristics.

The 1100 line, with standard flow ports, is compact, economical, and includes the same high quality, rugged features and trim as the 1300 line.

Most valve users have applications suited to both of these new OIC valve lines. Write for Bulletin *#195-R* illustrating features and specifications that fit these newest forged steel valves to your services.

THE OHIO INJECTOR COMPANY • WADSWORTH, OHIO

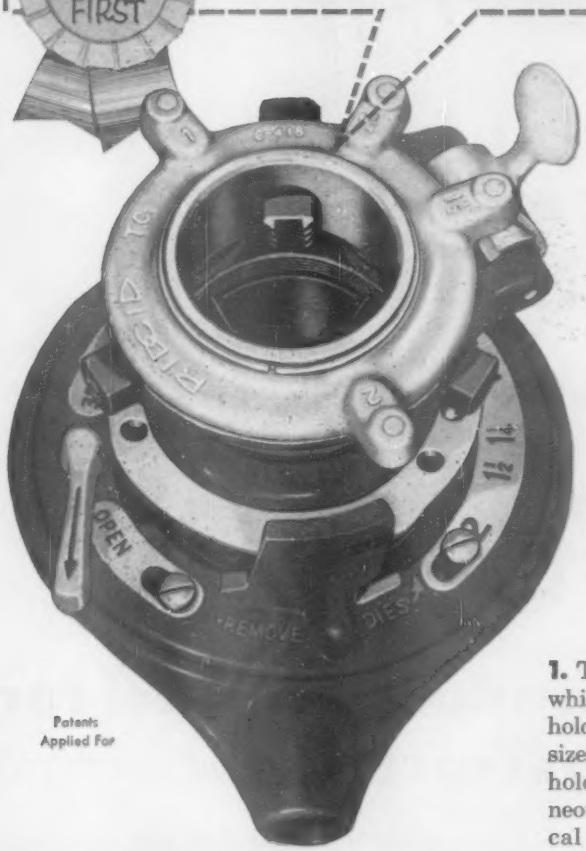
VALVES | **FORGED & CAST STEEL, LUBRICATED PLUG, BRONZE & IRON VALVES**

Big News! RIDGID 65R

Now Has A Revolutionary New

True-Centering Workholder

Another RIDGID FIRST



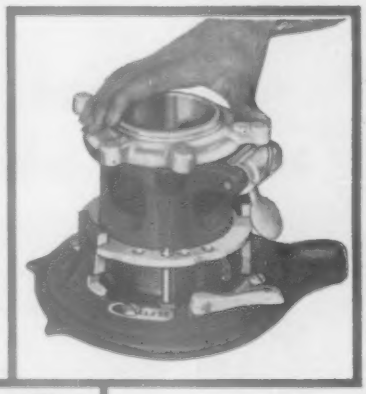
Patents Applied For

That Guarantees Always True Straight Threads

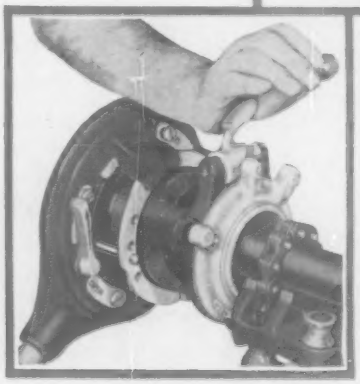
...even on over or under size pipe

Because All 3 Workholder Jaws Close At One Time!

Here's How It Works . . .



1. Turn cam plate which pre-sets workholder to desired pipe size, closes *all* 3 workholder jaws simultaneously by 1 mechanical action, for exact centering of die stock on pipe, even if pipe is over or under size.



2. When threader is on pipe, all 3 workholder jaws tighten in 1 action by bump of forged cam lever with palm of hand. Jaws grip and hold tight. Threads are *always* straight and true.

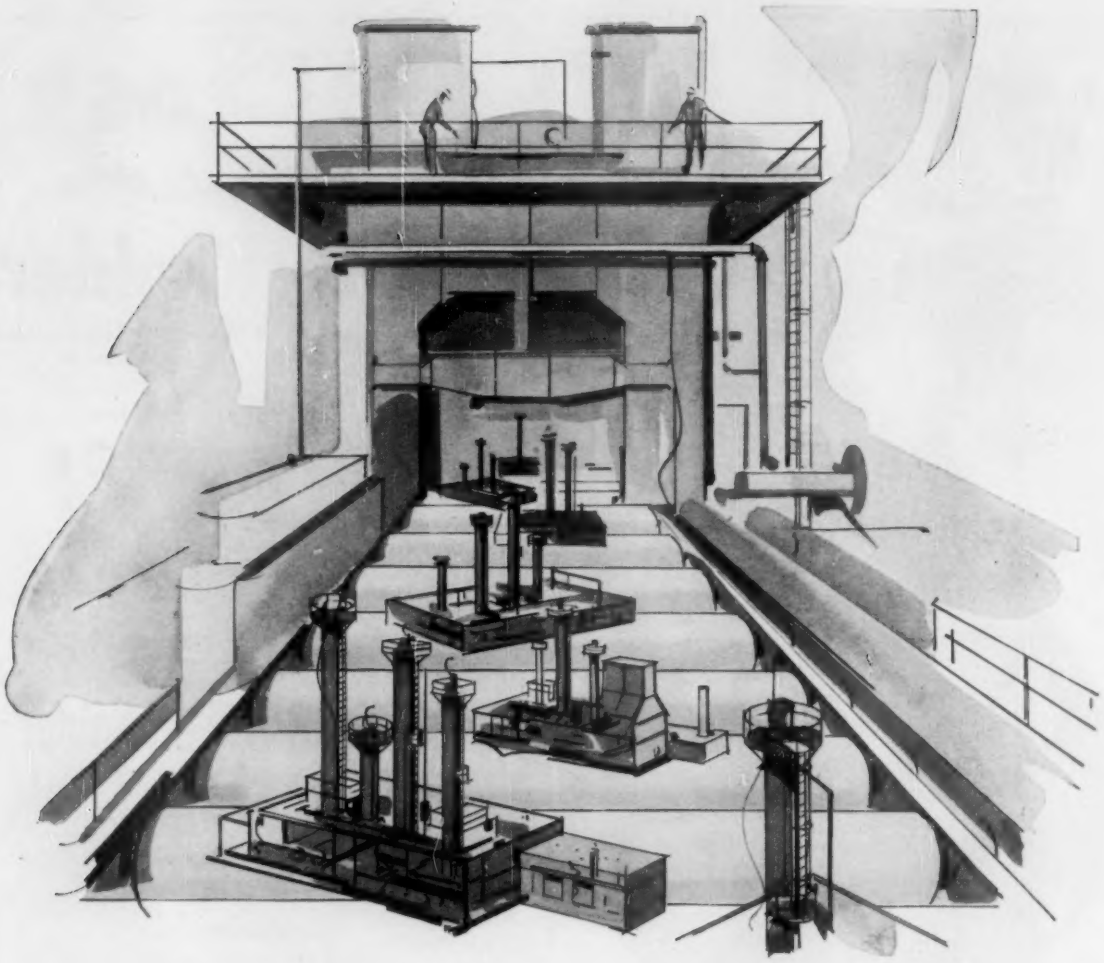
New TC Workholder fits your old 65R

. . . easy to change—ask your Supply House.

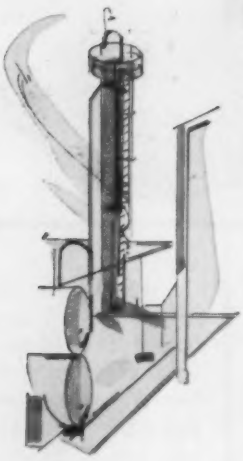
RIDGID 65R is jam-proof—kicks out automatically when standard thread is cut. Threads 1″ to 2″ pipe or conduit with 1 set of dies that stay in threader. Change from size to size in only 8 seconds. Instant workholder setting. With new TC workholder, 65R is far the most for your money—ask your Supply House today!

RIDGID
Work-Saver Pipe Tools

The Ridge Tool Company, Elyria, Ohio, U.S.A.



There's no production line for plant construction



There's nothing routine about this business of building petroleum refineries, chemical plants, and petrochemical plants. Every construction project is a different problem, a fresh challenge, an opportunity for new accomplishments. That's why we've assembled here at Procon an engineering and construction staff with the broad experience, the technical know-how, and the creative enthusiasm to meet and master any construction problem to your better-than-ordinary satisfaction. If you are in a building mood, Procon can help you!

PROCON *Incorporated*

1111 MT. PROSPECT ROAD, DES PLAINES, ILLINOIS, U. S. A.

PROCON (CANADA) LIMITED, TORONTO 18, ONTARIO, CANADA
PROCON (GREAT BRITAIN) LIMITED, LONDON, W. C. 2, ENGLAND
PROCON INTERNATIONAL S. A., SANTIAGO DE CUBA

WORLD-WIDE CONSTRUCTION FOR THE PETROLEUM, PETROCHEMICAL, AND CHEMICAL INDUSTRIES

Rockwood Double Strength FOAM puts out flammable liquid fires quicker, at lower cost. Three parts FOAM liquid, 97 parts water and 900 parts of air create a heat-resistant blanket.

Put out fires fast with Rockwood Double Strength FOAM... *and do it inexpensively!*

Rockwood Double Strength FOAM liquid puts out flammable liquid fires quicker at lower cost. Tenacious, fire-smothering bubbles efficiently sweep fire away, and best of all, you pay for only three parts per thousand of the actual extinguishing agent. Three parts of FOAM liquid combine with 97 parts of water and 900 parts of air. The water cost is negligible . . . the air is free . . . obviously the cost of the extinguishing agent must be low.

If you are using other agents in the form of liquids, powders or gases you pay for 100% of the extinguishing agent, against 0.3% for Rockwood Double Strength FOAM . . . and shipping and handling costs are proportionately higher. With Rockwood Double Strength FOAM you buy only the material that binds large volumes of air and water into an efficient fire extinguishing agent. This material is designed to combine with nature's most plentiful materials, air and water, to literally multiply itself hundreds of times.

Rockwood Double Strength FOAM is economical to use . . . not only for actual fire fighting but for training better Fire Fighters.

Send in the coupon below for complete information. Tested and listed by Underwriters' Laboratories, Inc. Distributors in all principal industrial areas.

ROCKWOOD SPRINKLER COMPANY

Engineers Water . . . to Cut Fire Losses

ROCKWOOD

ROCKWOOD SPRINKLER COMPANY
Portable Fire Protection Division
1590 Harlow Street
Worcester 5, Massachusetts

Please send me your illustrated booklet on Rockwood fire-fighting products.

Name.....

Title.....

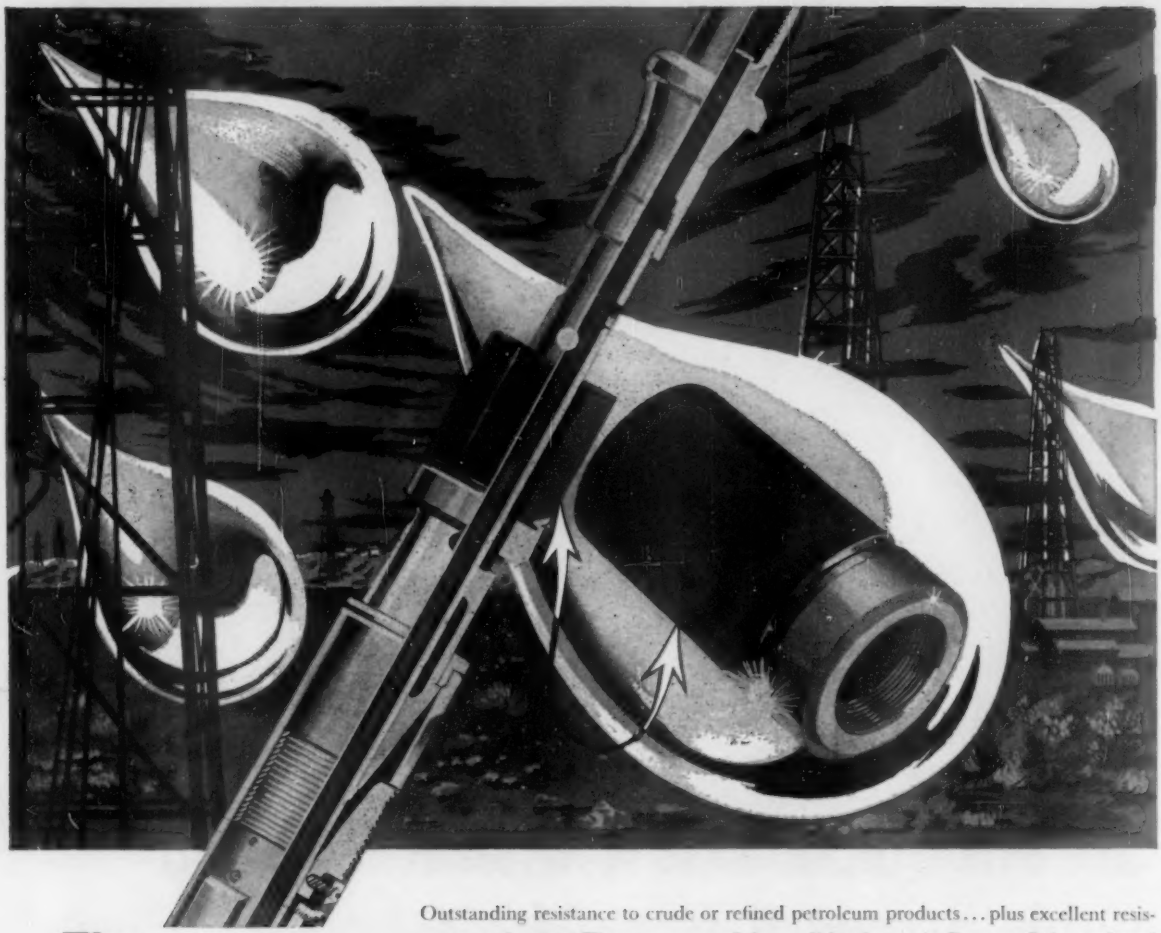
Company.....

Street.....

City.....*Zone*..*State*.....

Naugatuck PARACRIL

THE OIL-RESISTANT NITRILE-TYPE RUBBER



The RUBBER that gets along BEST with oil

Outstanding resistance to crude or refined petroleum products... plus excellent resistance to abrasion! Those are some of the qualities that make PARACRIL® the preferred rubber for the petroleum industry.

When a manufacturer's literature states that the rubber parts of drilling tools, inner tubes of oil hose, and seals or diaphragms for oil pumps are "made of special synthetic rubber that is resistant to oil, gas, acids and most other chemicals," it is describing the properties of PARACRIL.

A family of 10 different types of PARACRIL nitrile rubber—3 of them new "cold" types—now offers manufacturers the widest range of physical properties... plus oil resistance! Whether you are a manufacturer or user, insure *maximum satisfaction* by specifying PARACRIL for all rubber goods used in direct contact with petroleum oils, greases or distillates.

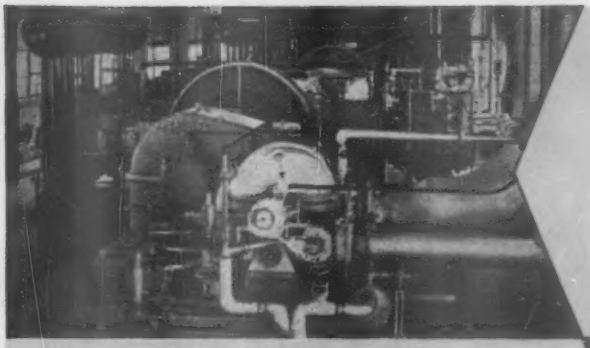
Naugatuck Chemical

Division of United States Rubber Company
Naugatuck, Connecticut

US RUBBER

IN CANADA: NAUGATUCK CHEMICALS, Elmira, Ontario • Cable Address: Rubexport, N.Y.
Rubber Chemicals • Synthetic Rubber • Plastics • Agricultural Chemicals • Reclaimed Rubber • Latices

Need a long-life gear unit for refinery service?



SPEED REDUCERS

Farrel speed reducers are adaptable in critical detail. This results in the solution of innumerable application problems. Designs include single, double and multiple reduction units, speed change units, and drives to meet special requirements.

Shown at the left, are two double reduction gear units, each transmitting 920 HP at 4000 RPM to a compressor operating at 300 RPM.

SPEED INCREASERS

Farrel type SI gear units are specially designed for the high peripheral speeds encountered in speed increasing applications. Speed ratio range from 1:1 to 12:1 with one pair of gears. Special units having two sets of gears are made with ratio range from 12:1 to 40:1.

In the illustration at the right, a type SI unit is transmitting 375 HP and stepping up the speed from vertical gas engine to hot oil pump in refinery.

RIGHT ANGLE DRIVES

Type RA vertical drives are used extensively for either increasing or reducing speed from internal combustion engines or high-speed turbines to vertical pumps. Hollow vertical shaft, which permits easy adjustment of the pump shaft without disturbing gears or bearings, can be supplied.

At the left, two RA-20 vertical right angle units are transmitting 250 HP from steam turbines at 4000 RPM to deep-well water pumps at 1746 RPM.

When you choose Farrel, you get the gear unit that's right for the job. What's more, you're assured of *sustained* operating efficiency throughout a long service life, thanks to sound engineering, accuracy of manufacture, and use of highest grade materials.

The gears have precision generated teeth; shafts and bearings are factored to safeguard against interruption of vital processes; gear cases proportioned to withstand repeated heavy peak loads; joints sealed against dirt.

FB-996

Detailed bulletins, on any of the gear units mentioned, available on request.

FARREL-BIRMINGHAM COMPANY, INC., ANSONIA, CONN.

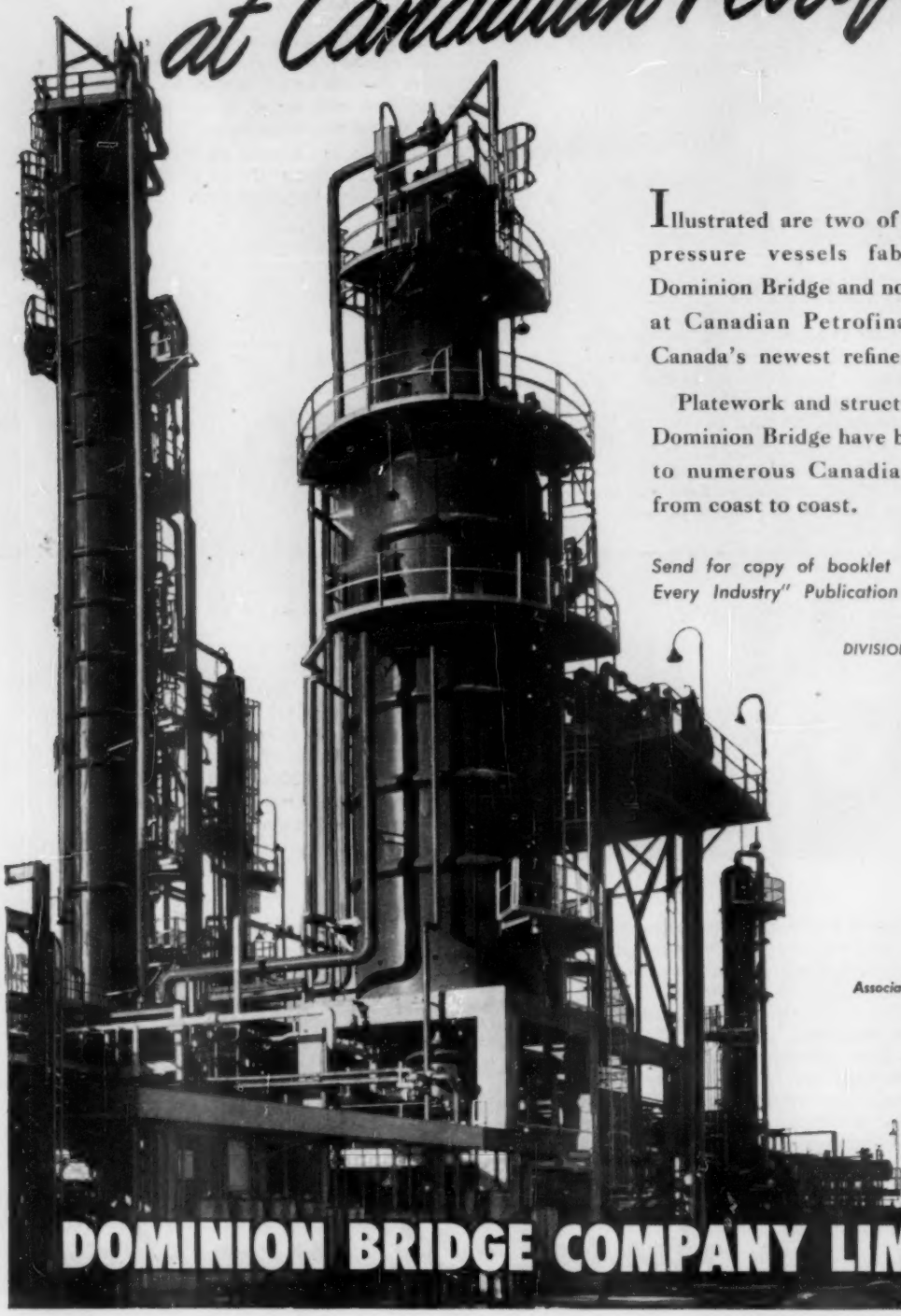
Plants: Ansonia and Derby, Conn., Buffalo and Rochester, N. Y.
Sales Offices: Ansonia, Buffalo, Boston, Akron, Ann Arbor, (Mich.), Chicago, Minneapolis, Fayetteville (N. C.), Los Angeles, Salt Lake City

OIL FIELD REPRESENTATIVES:

Hercules-Lupfer Engine Sales Co., 124 N. Boston St., Tulsa 1, Okla.
V. W. Osborne, 860-A M&M Building, Houston 2, Texas
European Office: Piazza della Republica 32, Milano, Italy

Farrel-Birmingham®

DOMINION BRIDGE
at Canadian Petrofina



Illustrated are two of many large pressure vessels fabricated by Dominion Bridge and now in service at Canadian Petrofina Limited—Canada's newest refinery.

Platework and structural steel by Dominion Bridge have been supplied to numerous Canadian refineries from coast to coast.

Send for copy of booklet "Platework for Every Industry" Publication No. PNN-100

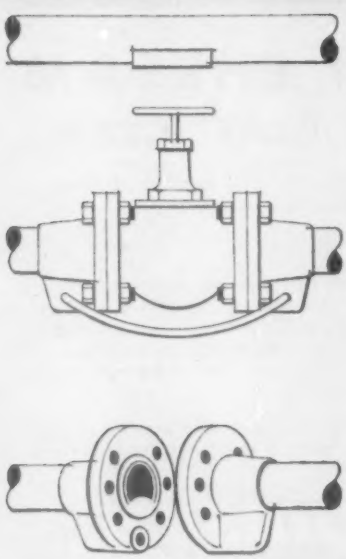
DIVISIONS • PLATEWORK
• STRUCTURAL
• MECHANICAL
• BOILER
• WAREHOUSE

Plants at:
MONTREAL
OTTAWA
TORONTO
WINNIPEG
CALGARY
VANCOUVER

Associate Company Plants at:
AMHERST
QUEBEC
SAULT STE. MARIE
EDMONTON

DOMINION BRIDGE COMPANY LIMITED

With this new round shape, UNITRACE costs substantially less per foot. And since the steam passage has less outside wall area, external radiation heat loss is reduced. The need for thermal insulation is often eliminated. When insulation is used, it costs less because standard pre-formed pipe covering can be used.
to cut costs,
boost efficiency
of steam traced pipe...
ALCOA UNITRACE has a NEW SHAPE
for lower cost per foot...
easier joining...
less heat loss...better
internal heat transfer



Sections of UNITRACE in the new shape can be easily and quickly joined by the weld and patch method (top). And a brand new UNITRACE flange—with product and steam passages cast as integral parts of the flange—simplifies installation of valves (center) and other flanged connections (bottom).

Want to save money on steam-traced piping? Here's good news for your pocketbook! ALCOA® UNITRACE *has a new cost-cutting shape* . . . a round section matching standard pipe shapes . . . available in 1½", 2", 3" and 4" sizes.

With steam and product passages extruded in a single unit of light, strong, corrosion-resistant Alcoa aluminum alloy 3003-F, UNITRACE completely eliminates the cost of external steam jackets or tracer tubes. And the new UNITRACE shape makes possible these *extra* savings:

Lower cost per foot . . . total volume of metal is less; material costs are lower.

Easier, faster joining . . . new configuration (with exterior grooves for quick steam passage identification) makes mating and joining fast and simple to cut installation costs.

Less external heat loss . . . improved internal heat transfer . . . the new design reduces area for external radiation loss.

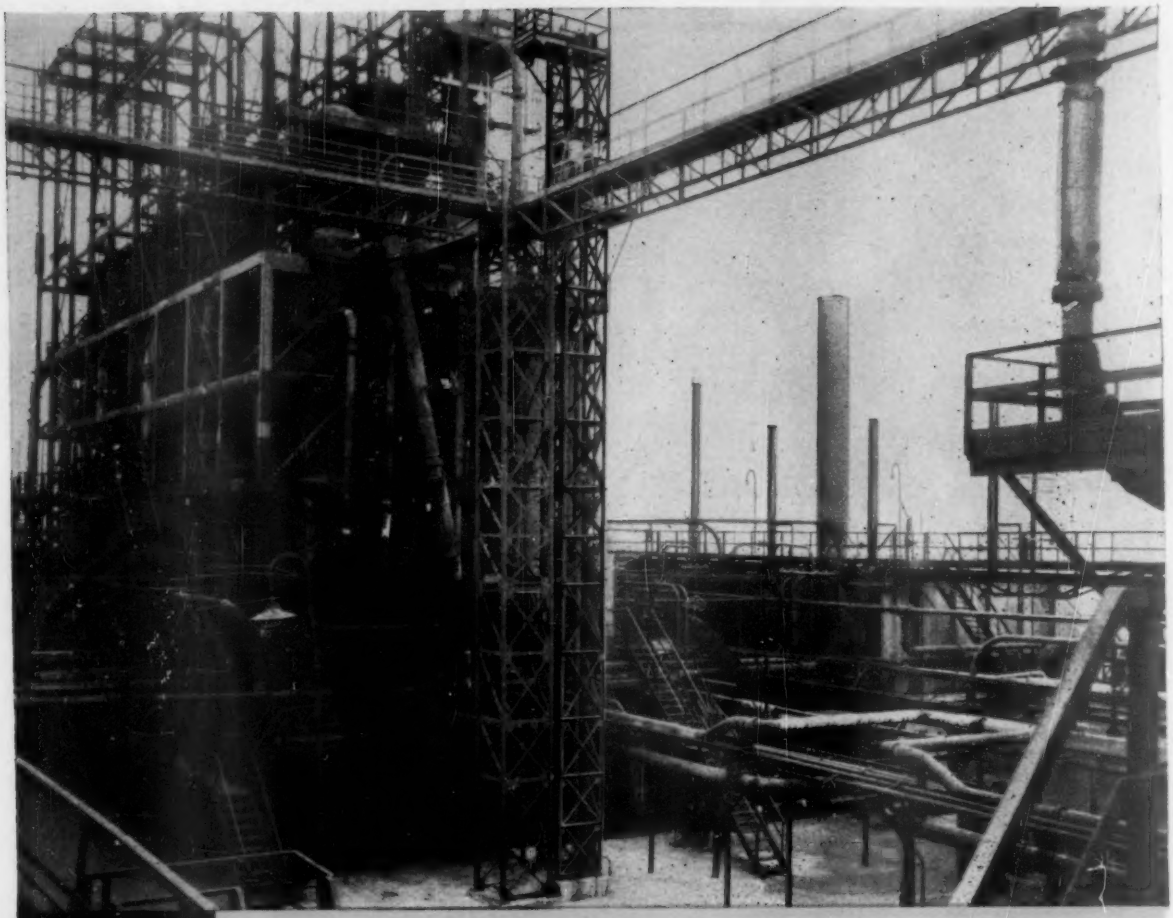
The natural corrosion resistance of aluminum makes UNITRACE ideal for handling naval stores, molten sulfur, ammonium nitrate solutions, glacial acetic acid, fatty acids, tar, pitch, wax, urea and similar products which normally require heated transfer lines.

Find out today how *you* can use ALCOA UNITRACE to cut costs and improve efficiency of your heated transfer lines. Call your nearest Alcoa sales office, or write Aluminum Company of America, 904-C Alcoa Building, Pittsburgh 19, Pennsylvania.

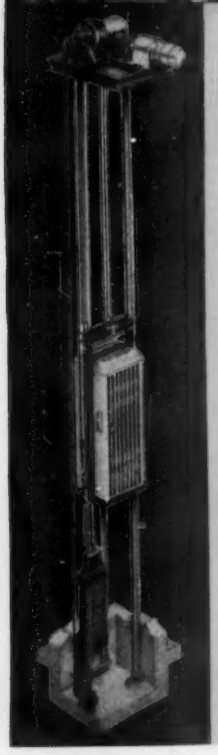
ALCOA ALUMINUM
ALUMINUM COMPANY OF AMERICA

THE ALCOA HOUR
TELEVISION'S FINEST LIVE DRAMA
ALTERNATE SUNDAY EVENINGS

Write for this FREE BOOKLET!
This new, illustrated booklet contains complete engineering, specification and fabrication data on ALCOA UNITRACE in the new shape. It's your guide to low cost heated transfer lines. Write for it today!



A typical installation of an EHRSAM ELEVATOR at a Gulf Coast refinery.



Safe, Low Cost EHRSAM
ELECTRIC ELEVATOR FOR "CAT" CREWS

FACTS:
Complies with American Standard Safety Code, all state and local codes. Machinery and cab can be furnished galvanized for outdoor installation . . . lift rate, 90 ft. per minute. For special applications, speeds of from 50-120 ft. per minute are available.

SIZES:

2'3" x 2'3"	—	300 lb. capacity (1½ Hp.)
2'9" x 2'9"	—	500 lb. capacity (2 Hp.)
4' x 4'	—	1000 lb. capacity (3 Hp.)
4'6" x 6'	—	2000 lb. capacity (7½ Hp.)

Maximum lift 250 feet. All-metal car with collapsible door. Magnetic brake. Emergency exit and safety door. Rigid, electric-welded all-steel frame.

All components factory assembled and pre-tested for easy installation. Complete operating instructions and detailed drawings included with each unit. Furnished with all elevator safety equipment required by code. All electrical equipment can be furnished explosion proof for either 220 or 440 volts.

WRITE, WIRE OR PHONE FOR ILLUSTRATED BROCHURE AND LIST OF EHRSAM ELECTRIC ELEVATOR CUSTOMERS.

Push-button, car-type for 1 to 6 passengers.
Easy to run, inexpensive to operate, simple to install.

EHRSAM®

THE J. B. EHRSAM & SONS MFG. CO.
DEPT. OG, ENTERPRISE, KANSAS
"OVER 80 YEARS OF DEPENDABLE SERVICE"

SALES OFFICES: Denver, Colorado; Fort Worth, Texas; Kansas City, Kansas.
WEST COAST: Ehrsam Pacific, Inc., Riverside, California.

SHOWCASE...

NEW EQUIPMENT

Plastic Lining Material Protects Pipe, Vessels

Here is a new plastic lining material that exhibits high chemical resistance to acids, alkalis, oxidants, and most solvents, according to the maker. Named Kel-F, the material is a plastic laminate that can be cemented to any surface with almost any contour.

Nontoxic and noncontaminating, the material has a temperature range of —100° to 350° F. And it presents a nonwetting and nonsticking surface, with strong abrasive resistance.

The plastic laminate is expected to be valuable for lining tanks, vessels, reactors, drums, pails, pipe, shoots, hoppers, fume hoods, and ducts. It also is suitable for surfacing laboratory bench tops, floors in chemical plants, and other surfaces exposed to extremely corrosive conditions. **Write or call: United States Gas Co., Camden 1, N. J., for details on Kel-F plastic laminate.**

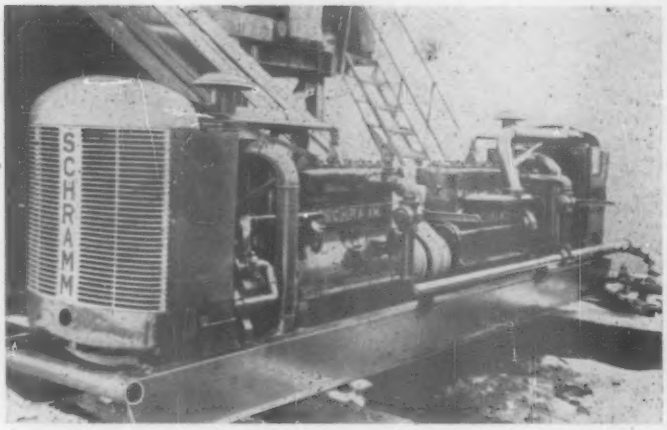
•

Steel-Hardening Compound Can Speed Tool Repair

By three means, Chromelloy, a new steel-hardening compound, hardens from the surface inward — by a carburizing, nitriding, and alloying effect. In addition to hardening, it may often increase the tensile strength throughout the steel, according to the maker. It can be used for hardening a variety of steels.

One advantage offered is that tools can be made of mild steel and then very easily hardened with Chromelloy. Pieces thus made will last several times longer than tools made of tool steel and hardened in the ordinary way, the maker says.

Hardening is simple. The tools or parts are heated, dipped in Chromelloy powder, reheated for about 2 minutes, and quenched. The entire operation takes only about 5 minutes. One hour of pack hardening with Chromelloy will produce a 1/32-in. case of 65-68 Rockwell C, using cold-rolled steel, the maker points out. **Write or call: U. S. Metallurgical Labs., Div. of General Power Services, 381 Fourth Avenue, New York 16, N. Y., for details on Chromelloy.**



Compressor Supplies Air for Drilling

Here's a new 1,200-cu. ft. per minute air-drilling compressor unit which is belt-driven from the rig's compound in the position normally occupied by the mud pump. Utilizing the available rig power, through seven V-belts for each compressor, the unit can be used on a 16-groove sheave on the rig compound, with two belts omitted in the center grooves for installing and removing belts. It also can be driven by an independent source mounted on a common skid base.

The maker especially recommends the compressor unit for oil-field service. Ruggedly constructed and compact, the unit is skid-mounted, self-contained, and equipped with its own cooling system.

Designated the Model 1200, it is designed for continuous oil-field service. Although it requires only 320 hp. at the flywheel, the manufacturer recommends its use with rigs having at least 750 hp. The extra power is to compensate for losses incurred due to ro-

Send this **Showcase Coupon**

to the **Manufacturer** of the item in which you are interested. See name, address, and equipment name and/or model, in bold-face type at end of description.

NAME AND/OR MODEL NUMBER.....

.....

.....

Described in OIL AND GAS JOURNAL - Issue of March 25, 1957

NAME.....TITLE.....

COMPANY.....

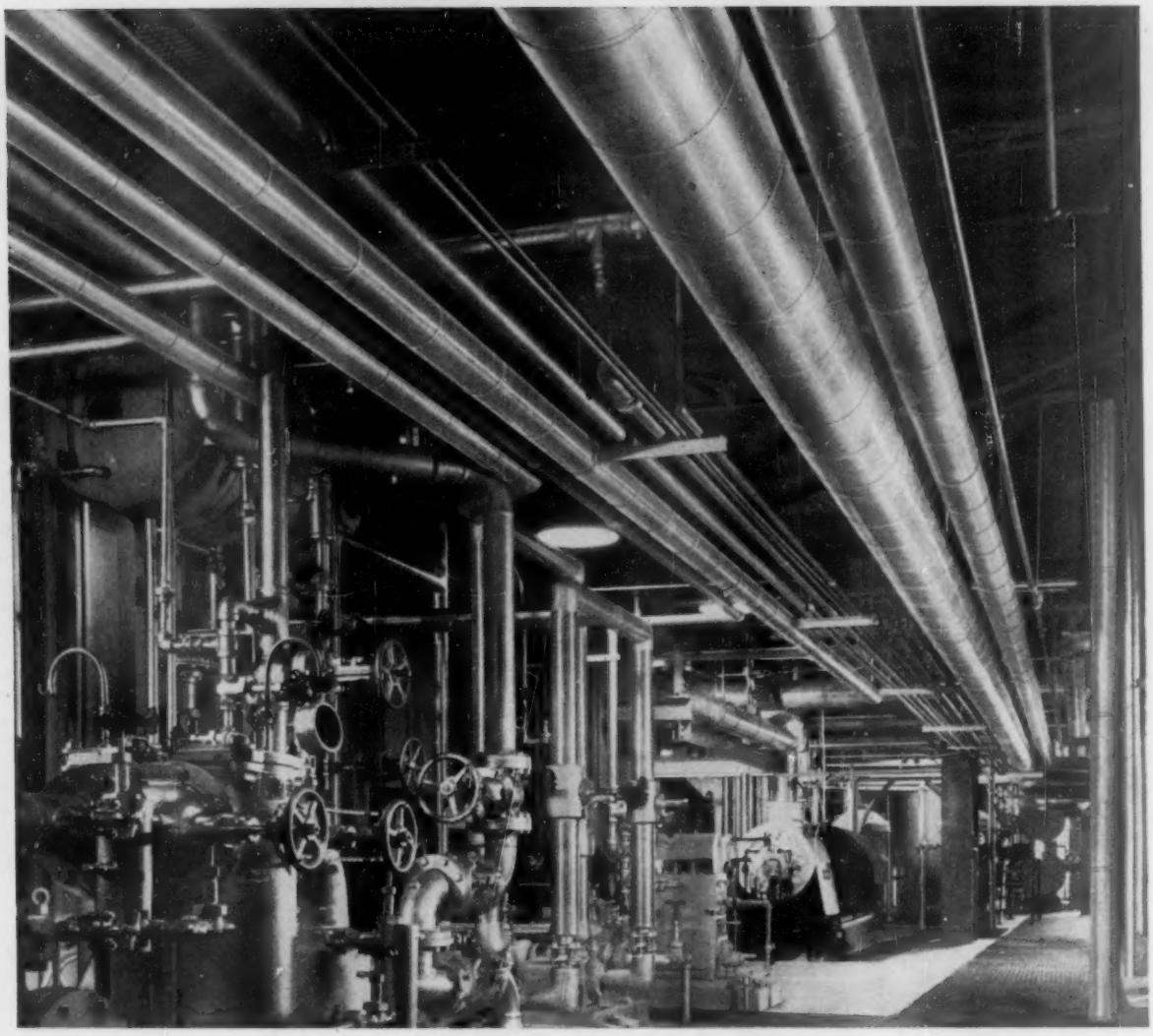
ADDRESS.....

CITY.....STATE.....

DATE.....

Kaiser Aluminum snap jackets give you

A NEW, FASTER WAY TO



Now, with *snap jackets* made with Kaiser Aluminum, one man can install aluminum pipe jacketing quickly and economically.

An outstanding example of recent improvements in aluminum jacketing techniques, the *snap jacket* is a sheet of Kaiser Aluminum, roll-formed into a tubular shape and stiffened along one edge by an angular crimp. Rigid, but sufficiently flexible, the jacket can be quickly snapped into place around insulated pipe by only *one man* and assures a more durable, more weather-tight installation.

Because it is made with Kaiser Aluminum, the *snap jacket* gives you improved appearance and longer life at low cost.

For immediate assistance on any jacketing requirements, call the Kaiser Aluminum sales office listed in your phone directory. Process Industries Department, Kaiser Aluminum & Chemical Sales, Inc., *General Sales Office,* Palmolive Bldg., Chicago 11, Illinois; *Executive Office,* Kaiser Bldg., Oakland 12, California.

INSTALL ALUMINUM JACKETING

1. ONE MAN can quickly position tubular *snap jacket* for installation.

2. NEXT, same man easily snaps *snap jacket* around pipe, places laps properly and bands the jacket to complete the job.

3. TO SAVE even more time, two men can work together . . . one man snaps jackets in place, follow-up man bands them.

For this new, faster way to install aluminum jacketing, Kaiser Aluminum alloy 5005-H16 is recommended. Other alloys may be used depending on the job, but it is desirable to use one alloy throughout.

Recommended thicknesses of sheet aluminum:

For insulation O.D. of 12.75" and under	**0.020"**
For insulation O.D. of 14" and larger	**0.024"**

Kaiser Aluminum

materials for the process industries

For *complete* information about aluminum jacketing with illustrated on-the-job techniques, send for the new 40-page *free* manual "Kaiser Aluminum Insulation Jacketing Materials And Methods."

MAIL THIS COUPON TODAY!

KAISER ALUMINUM & CHEMICAL SALES, INC.,
Process Industries Department, Room 71210
1924 Broadway, Oakland 12, California

Please send my copy of your new manual "Kaiser Aluminum Insulation Jacketing Materials And Methods." I understand there is no obligation.

NAME_____ TITLE_____

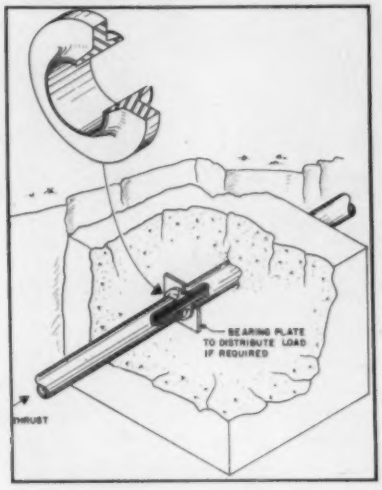
COMPANY_____ ADDRESS_____

CITY_____ STATE_____

New Equipment

tation and occasional hoisting while pumping air when pipe is stuck, in order not to drain the available rig horsepower.

When two 1,200-cu. ft. per minute compressors are used, at least 1,000 hp. is recommended off the compound to supply air and to provide sufficient power for other rig requirements. Low maintenance cost, high mobility, and flexibility of the packaged unit are important features of the new compressor, the manufacturer states. **Write or call: Petroleum Div., Schramm, Inc., 5531 Dyer Street, Dallas, Tex., for details on Model 1200 compressor.**



Anchor Forging Holds High-Pressure Pipe

The problem of how to satisfactorily anchor high-pressure oil and gas pipelines, particularly at compressor stations, river crossings, and valve and meter settings, may be adequately solved with this Tube Turn welding-neck anchor forging, the maker reports. The forging takes the form of a double-hubbed flange, with no bolt holes. It may employ a bearing plate to distribute the load.

The hubs are of the straight-taper type recently adopted by MSS for large-diameter pipeline flanges. They are butt-welded to the pipe where it is to be held immobile. The assembly is then buried in a reinforced-concrete block of suitable dimensions.

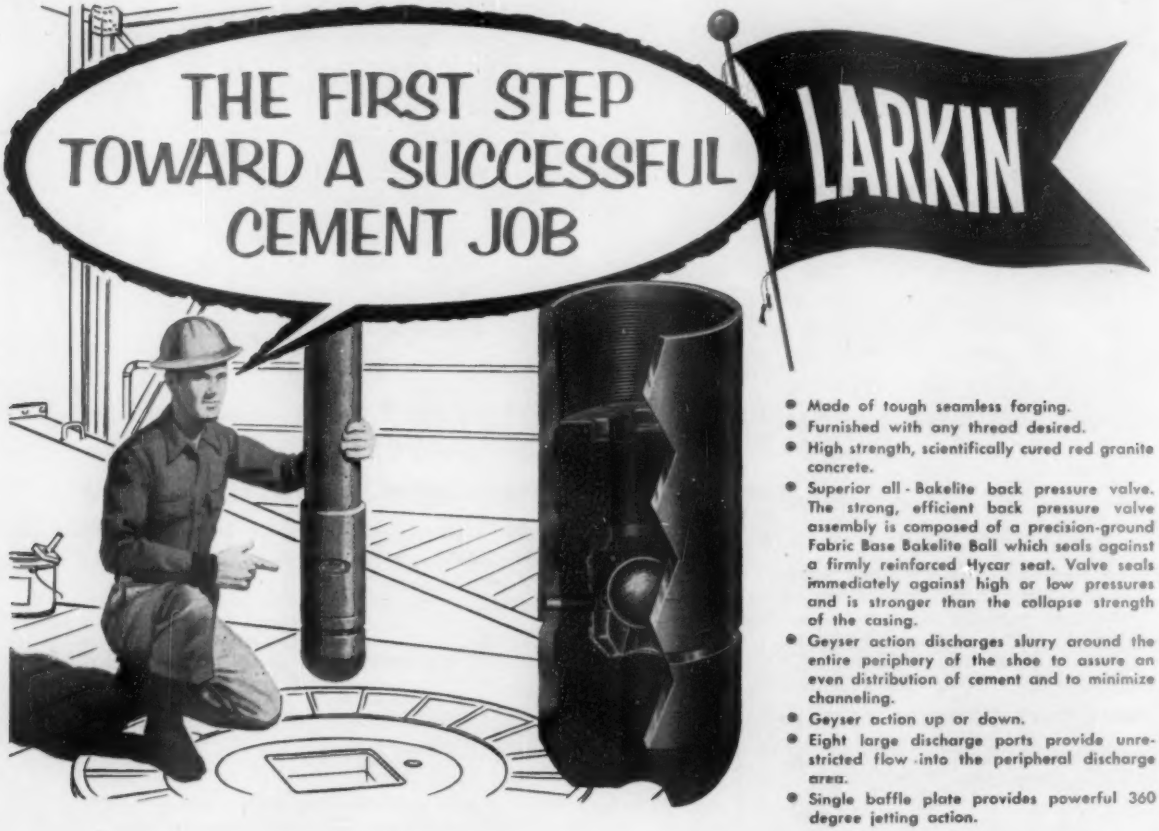
The welding-neck anchor forging is produced in any of the materials customarily used for flanges. And it is available in sizes to match any pipe dimensions and for the usual pressure conditions. In each instance, it is manufactured to meet specific installation requirements. **Write or call: Tube Turns, Div. National Cylinder Gas Co., 224 East Broadway, Louisville 1, Ky., for details on welding-neck anchor forging.**

•

Polyethylene-Base Coating Protects Refinery Buildings

Both buildings and equipment in refineries and petrochemical plants can be protected with this new coating against severe chemical and weather exposure, according to the manufacturer. Called Maintz, the coating is based on Du Pont chlorosulfonated polyethylene.

In combination with silicone and other resins, it produces a tough and long-lasting coating. And it does not dry to a hard and brittle finish. Instead, it forms a tough, resilient coating with high resistance to abrasion, weathering, and chemical corrosion. In



- Made of tough seamless forging.
- Furnished with any thread desired.
- High strength, scientifically cured red granite concrete.
- Superior all-Bakelite back pressure valve. The strong, efficient back pressure valve assembly is composed of a precision-ground Fabric Base Bakelite Ball which seals against a firmly reinforced Hycar seat. Valve seals immediately against high or low pressures and is stronger than the collapse strength of the casing.
- Geyser action discharges slurry around the entire periphery of the shoe to assure an even distribution of cement and to minimize channeling.
- Geyser action up or down.
- Eight large discharge ports provide unrestricted flow into the peripheral discharge area.
- Single baffle plate provides powerful 360 degree jetting action.

addition, it's elastic enough to withstand extremes of expansion or contraction, without cracking. It retains this property at temperatures as low as —40° F.

Its combination of chemical and weather resistance has been proved in tests where exposure to both salt spray and tropical weather for over 2 years have shown no measureable degradation, the maker reports. **Write or call: West Chester Chemical Co., Box 39, West Chester, Pa., for details on Maintz coating.**

Measuring Wheel Can Be Towed

A specially designed hitch allows this Model 600 Rolatape measuring wheel to be hitched to a car or tractor for measuring long distances over fairly rough terrain.

The wheel has a built-in tabulator that records and measures distances up to 18 miles and over, before resetting itself. And it can be reset at any time. **Write or call: Rolatape, Inc., P. O. Box 1190, Santa Monica, Calif., for details on Model 600 measuring wheel.**

Corrosion-Resistant Coating Goes on With Brush

By brush, roller, or spray, this new corrosion-resistant coating, called Permaspray, can be applied to surfaces. And the company states that metals properly cleaned and coated with the material and submerged for 18 months in hydrochloric acid, caustic soda, salts,

....Give you SAFETY, VALVE EFFICIENCY and a PERFECT DISTRIBUTION OF CEMENT as it starts up the annulus.

Larkin Geyser Float Shoes do everything within the scope of such equipment to accomplish a successful cement job. Specify Larkin "... through your supply store"... the first step toward a successful cement job!

LARKIN PACKER COMPANY, INC.
WAXAHACHIE, TEXAS

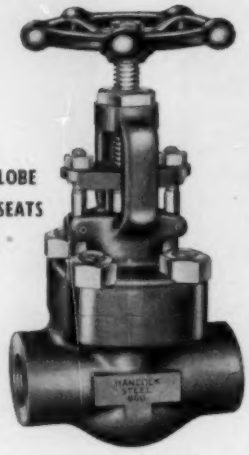
LARKIN ...Through Your Supply Store

LARKIN LEADERSHIP HAS BEEN EARNED BY YEARS OF DEPENDABLE PERFORMANCE

NEW 600# STEEL

NEW

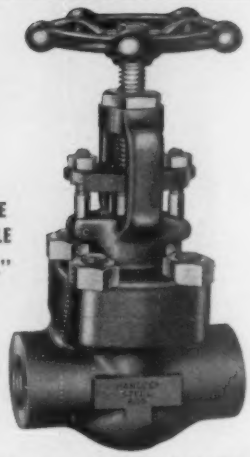
TYPE 5500 — 600# GLOBE
INTEGRAL HARD-FACED SEATS
"500 Brinell"
Stainless Steel Discs.



Especially suitable for high pressure steam and temperature services in power plants. **Sizes:** ¼" thru 2". **Standard Materials:** Forged carbon steel A.S.T.M. A-105 Gr. II. **Alternate Body and Bonnet Materials:** 1¼% Chrome, ½% Moly Steel, A.S.T.M. A-182 Gr. F-11. **Connections:** Screwed and Socket Weld Ends. For all pressures up to 600 psi at 910°F. O.W.G. — 2000 psi at 100°F.

NEW

TYPE 5520 — 600# GLOBE
TYPE 5530 — 600# ANGLE
RENEWABLE "300 BRINELL"
STAINLESS STEEL SEATS
"500 Brinell" Stainless Steel Plug Discs.



Ideal for processing plants and general industrial service. **Sizes:** ¼" thru 2". **Standard Materials:** Forged carbon steel A.S.T.M. A-105 Gr. II. **Alternate Trims:** 18-8 Type 316 Stainless Steel; Monel. **Alternate Body and Bonnet Materials:** 5% Chrome, ½% Moly Steel, A.S.T.M. A-182 Gr. F-5; 18-8 Type 304 Stainless Steel A.S.T.M. A-182 Gr. F-304. **Connections:** Screwed, Socket Weld and Flanged Ends. **Screwed and Socket Weld Valves:** For all pressures up to 600 psi at 910°F. O.W.G. — 2000 psi at 100°F. **Flanged Valves:** For all pressures up to 600 psi at 850°F. O.W.G. — 1440 psi at 100°F.

These 600# bolted bonnet forged steel valves really make sense to every man who knows the economy of quality valves. Designed into them are plus values that substantially reduce profit-draining production shut-downs, maintenance problems and inventory costs. Built as companions to the widely-used Type 950 Hancock 800# Steel Gate Valves, they offer:

Thick, Rigid Body and Bonnet Flanges that can withstand more than ten times the rated pressure of the valve. The flanges butt — no bending, no distortion.

Re-usable Flexitallic Bonnet Gasket, in combination with the rigid body and bonnet flanges, prevents bonnet joint leakage. The gasket is a spiral-wound ribbon of stainless steel with asbestos filler and spring-like compressibility. It rests in a groove in the body flange — cannot blow out even if pressures exceed ten times the rating of the valve. *Hancock 600# Steel Valves are the first globe valves to use this important feature.*

Maximum Use of Stainless Steel. Even the stem, swing bolts, nuts, thread bushings and packing gland followers are stainless steel — your assurance of quality that saves throughout the long life of these valves.

The 5500 Line of Hancock 600# Steel Valves is available in Globe, Angle, "Flocontrol," Lift Check and Hi-Pressure Drop designs. Whatever your needs, you can buy these valves with complete confidence in their functional perfection. Like all other Hancock Valves, they are precision engineered and carefully manu-

HANCOCK VALVES

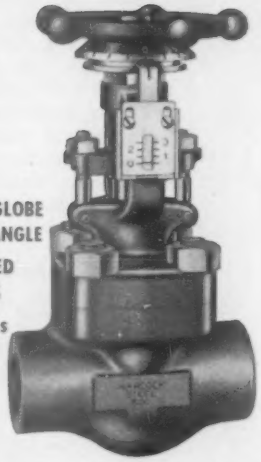
PHONE YOUR INDUSTRIAL SUPPLY DISTRIBUTOR. His broad knowledge and experience can be of real value to you. Let him help you select the right Hancock Bronze and Steel Valves for all your service requirements.

H1-57

HANCOCK VALVES

NEW

"FLOCONTROL"
TYPE 5525 — 600# GLOBE
TYPE 5535 — 600# ANGLE
RENEWABLE HARD-FACED STAINLESS STEEL SEATS
"500 Brinell" Stainless Steel V-Port Discs.



For general industrial service. Variable orifice, shut-off and index combined in a single valve. Any desired setting can be instantly duplicated. **Sizes:** ¼" thru 2". **Standard Materials:** Forged carbon steel. **Connections:** Screwed, Socket Weld and Flanged Ends. **Screwed and Socket Weld Valves:** For all pressures up to 600 psi at 910°F. O.W.G. — 2000 psi at 100°F. **Flanged Valves:** For all pressures up to 600 psi at 850°F. O.W.G. — 1440 psi at 100°F.

NEW

HI-PRESSURE DROP
TYPE 5505 — 600# ANGLE
INTEGRAL HARD-FACED SEATS
Stainless Steel Tube.

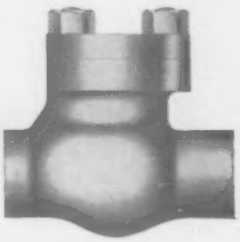
An orifice type valve, with shut-off and index in a single unit that permits the use of a smaller valve with a large capacity. Designed to withstand the terrific wrecking power of continuous blow-down. Also for use on feed-water, by-pass relief, in turbine washing processes, and where erosion is extremely severe. **Size:** 1". **Standard Materials:** Forged carbon steel. **Connections:** Screwed and Socket Weld Ends. For all pressures up to 600 psi at 910°F. O.W.G. — 2000 psi at 100°F. A.S.M.E. maximum boiler pressure 970 psi.

factured. You can be sure of long resistance to wire drawing, galling, steam cutting, erosion and corrosion — for leakproof tightness month after month. They surpass the toughest service demands of process and power piping systems in the most modern refineries, petrochemical, power and industrial plants. A high degree of standardization in all sizes simplifies both maintenance and inventory needs.

Let the durability, performance and economy of Hancock 600# Steel Valves save money for you. Whether you are adding facilities, building a new plant or setting up a revalving program, get all the reasons why these tough valves serve better and longer. Complete information is yours on request.

NEW

LIFT CHECK VALVE
TYPE 5540 — 600# GLOBE
RENEWABLE HARD-FACED STAINLESS STEEL SEATS
"500 Brinell" Stainless Steel Piston Discs.



For general industrial service. **Sizes:** ¼" thru 2". **Standard Materials:** Forged carbon steel. **Cap:** Bolted. **Connections:** Screwed, Socket Weld and Flanged Ends. **Screwed and Socket Weld Valves:** For all pressures up to 600 psi at 910°F. O.W.G. — 2000 psi at 100°F. **Flanged Valves:** For all pressures up to 600 psi at 850°F. O.W.G. — 1440 psi at 100°F.

When Hancocks go in, valve costs go down

A PRODUCT OF MANNING, MAXWELL & MOORE, INC.

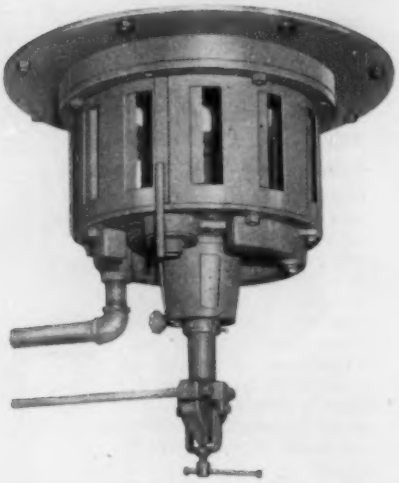
WATERTOWN 72, MASSACHUSETTS

MAKERS OF 'ASHCROFT' GAUGES, 'AMERICAN' INDUSTRIAL INSTRUMENTS, 'CONSOLIDATED' SAFETY AND RELIEF VALVES, 'AMERICAN-MICROSEN' INDUSTRIAL ELECTRONIC INSTRUMENTS, *Stratford, Conn.* 'HANCOCK' VALVES, *Watertown, Mass.* 'CONSOLIDATED' SAFETY RELIEF VALVES, *Tulsa, Okla.* AIRCRAFT CONTROL PRODUCTS, *Danbury, Conn. and Inglewood, California.* "SHAW-BOX" AND 'LOAD LIFTER' CRANES, 'BUDGIT' AND 'LOAD LIFTER' HOISTS AND OTHER LIFTING SPECIALTIES, *Muskegon, Michigan.*

In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario

*the Best**

VERTICAL COMBINATION GAS & OIL BURNER



JOHN ZINK

series

"DA"

* Oil spillage cannot cause gas burner plugging.

If the oil can be pumped, the "DA" can burn it.

No matter what calorific value gas is made available, this burner can handle it safely and quietly.

WE MAKE HEAT ... AROUND THE WORLD

For detailed information, write for Bulletin DA-357.

JOHN ZINK COMPANY

4401 SOUTH PEORIA TULSA 5, OKLAHOMA

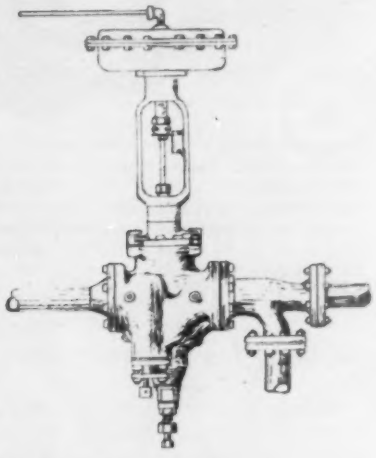
SHOWCASE . . .

New Equipment

gasoline, and fuel oil showed no signs of coating breakdown.

In tests in a Gulf Coast plant under severe conditions, parts of structures coated with Permaspray have withstood 3 years of exposure to hydrochloric acid, caustic fumes, and weathering conditions, the company reports.

Potential uses for the corrosion-resistant coating include protecting structures and equipment in refineries, petrochemical plants, and petroleum-storage tanks. For best protection, the maker recommends two coats of the coating, each about 3 mils thick. Each coat dries to a hard finish in 4 hours. **Write or call: Permaspray Mfg. Corp., League City, Tex., for details on Permaspray.**



Control-Valve Unit Simplifies Installation

Here's a new control-valve unit which may replace the complete conventional diaphragm control-valve installation, either standard or three-way, the maker reports.

Instead of the usual installation requiring a control valve, two block valves, and one bypass valve, or a three-way installation requiring a three-way control valve, three block valves, and two bypass valves, all with interconnecting piping, this Elsey control-valve unit combines in one valve body the repair and arrangement principles of the control valve together with stream flow shutoff and bypass devices.

All inner-valve parts are interchangeable between the company's diaphragm control valve and the diaphragm control-valve unit. The unit is designed so the repair or replacement of valve seats or change from normally open to normally closed valve position can be ac-

complished with the valve in the line and operating under pressure. And the addition of a three-way fitting and three-way inner valve converts the unit to a three-way installation. **Write or call: Elsey Corp., Bartlesville, Okla., for details on control-valve unit**

•

Fuel-Oil Additive Prevents Sludge in Tanks

Recent tests in a number of industrial plants, including a refinery indicate that Du Pont fuel-oil additive No. 2 can solve many problems in industrial heating plants, the company reports. The product is a sludge dispersant. It prevents sludge and gummy residue from forming in storage tanks by keeping tiny particles in the fuel from clustering together and settling to the bottom of the tank. **Write or call: Petroleum Chemicals Div., E. I. du Pont de Nemours & Co., Wilmington, Del., for details on fuel-oil additive No. 2.**

•

New Swivel Offers Several Improvements

Two series of this new swivel, 40 and 50 KG, will replace the King 40XV and 50XV swivels for shallow wells up to 4,800 ft. deep.

All of the best features of the Series XV swivels have been retained and several new features added, the maker announces. For example, the new KG series contains a new wash-pipe and packing-box arrangement which permits faster rotation. And the packing can be changed without breaking out. Changing the packing is simplified and thread galling is eliminated.

Other features include: (1) a zerk fitting to assure easy lubrication of the V type of packing and (2) an adjustable stuffing box to insure maximum life for the packing.

Applications for the swivel includes: (1) drilling relatively shallow oil wells and deep water wells, (2) workover rigs, (3) slim-hole drilling and drilling in, and (4) coring oil wells by the reverse-circulation method. **Writie or call: King Oil Tools, 7944 Dockal Road, Houston 20, Tex., for details on Series KG swivels.**

WILLIAMS

TOOLS OF INDUSTRY

FOREMOST! Since...Niagara's power was harnessed for industry.

1895 saw the first commercial transmission of Niagara's electric power. With unlimited power available, a new industrial age of high production, precision machining was born.

Since 1882, Williams has anticipated the tool requirements of manufacturers with a complete line of holders for turning, boring, threading, knurling, planing, shaping, cutting-off and side work. A full line of high speed and carbide cutters and set-up accessories is also available.

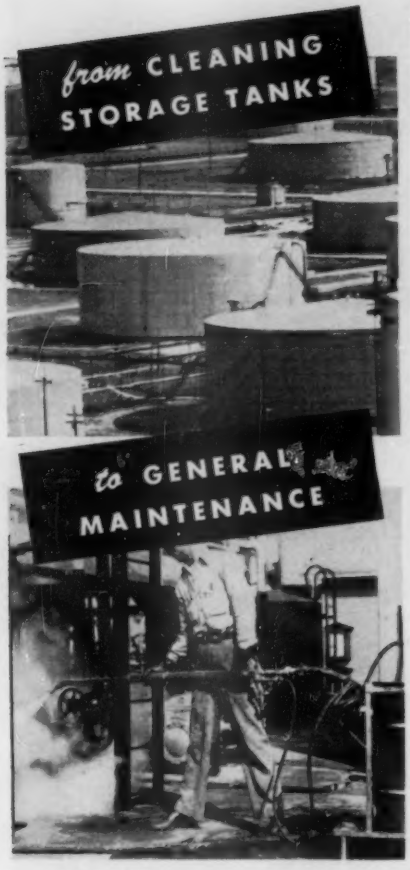
You get quickest delivery at lowest cost from your LOCAL DISTRIBUTOR.

Williams makes the broadest line of its kind. Write for Catalog 302.

J. H. WILLIAMS & CO.

412 VULCAN STREET, BUFFALO, N. Y.

BUFFALO • NEW YORK • CHICAGO • LOS ANGELES



Oakite cleaning does it better, reduces costs

Going inside an 80,000 gallon storage tank to clean manually was slow, wasteful; but with Oakite detergents and spray method, the entire inside was bared clean in only 12 hours, costs cut over 75%.

How to get at hard-to-reach surfaces and remove grease and muck without scraping or wire brushing? With an Oakite Steam-Detergent Gun. At one refinery, it helped a man do two weeks work in a day.

Just two more of the many ways the Oakite man and the materials, methods and equipment behind him can *simplify* and *save* on your cleaning operations. Send for Bulletin F-7629. Oakite Products, Inc., 39 Rector Street, New York 6, N. Y.

OAKITE

Export Division Cable Address: Oakite

Technical Service Representatives in Principal Cities of U. S. and Canada

SHOWCASE . . .

New Literature

Pipe Locators, Leak Detectors Catalog. This new 1957 Fisher utility catalog covers such electronic instruments as pipe finders, transistorized leak detectors, transistorized corrosion-control instruments, and water-well testing equipment. **Write or call: Fisher Research Laboratory, Inc., Palo Alto, Calif., for 1957 utility catalog.**

●

Antifoam for Industrial Waste Treatment. This factual information sheet describes the properties and applications for Hodag Antifoam S-88. According to the information sheet, this product is designed to efficiently prevent the formation of foam in activated-sludge waste-treatment plants. Liquid S-88 is applied manually or automatically to the aeration tanks. Usages of 0.5 to 1.0 p.p.m. are average for normal foaming conditions. **Write or call: Hodag Chemical Corp., 7247 North Central Park, Chicago 45, Ill., for data sheet on Antifoam S-88.**

●

Steel Making. This 104-page book titled, Born of Fire—Steel, provides a picture story of steel making from the ore through to the finished product. Printed in western Germany, the hard-cover-book contains 104 pictures in color. These pictures furnish an insight to the many steps that go into steel products. For example, one series traces the path of a boiler drum from an ingot into a sheet, then to the half-shells, and on to the finished drum. Similar pictures trace the path of steel pipe and tubing. **Write or call: Mannesmann Aktiengesellschaft, Post fach 6037, Dusseldorf, Germany, for book, Born of Fire—Steel.**

●

Automation of Water Treatment Plants. Technical Reprint T-148 (10 pages) discusses in detail the development of automation in boiler-feedwater and process-water treatment. The reprint presents several specific case histories pointing out the problems involved and the methods of solution. Flow diagrams illustrate these problems and their solutions. The reprint explains how water-treatment processes and equipment fall into three groups—mechanical, chemical, and ion exchange. These are further divided to indicate the many subdivisions and types of process. The paper classifies and discusses the types of measurements required by the processes and the types of control systems. It also includes a chart of the various types of demineralizers available, their application and advantages. **Write or call: Graver Water Conditioning Co., 216 West Fourteenth Street, New York 11, N. Y., for Technical Reprint T-148.**

●

Combustion-Testing and Air-Measurement Instruments are described and illustrated in two-page Bulletin 138. The instruments covered in the bulletin include: gas-pressure manometers, oil-flow graduates, sling psychrometers, air-velocity meters, filter gages, recording thermometers, carbon-monoxide detectors, CO_2 indicators, flue-gas thermometers, and pressure-point testers. **Write or call: General Scientific Equipment Co., 7516 Limekiln Pike, Philadelphia 50, Pa., for Bulletin 138.**

●

Mechanical Packings. This four-page, three-color folder lists and pictures the popular mechanical packings used on most applications in industrial, power, and process plants. It illustrates and describes shaft packings—both centrifugal and rotary—reciprocating-rod and plunger packings, valve-stem and piston packings, and gasketing materials.

'RUSS MASTER' SAYS . . .

KNOCK OUT RUST WITH THIS 1-2 PUNCH!

1. **Prime** with Rustmaster, proved by laboratory comparison tests to be the best rust inhibitor!
2. **Finish** with one of General's specialized industrial coatings.

RUSTMASTER SYSTEM

Ask for details and specifications.

GENERAL PAINT CORP., Tulsa and San Francisco

TORRINGTON *SPHERICAL ROLLER* BEARINGS

This bearing can take thrust, too!

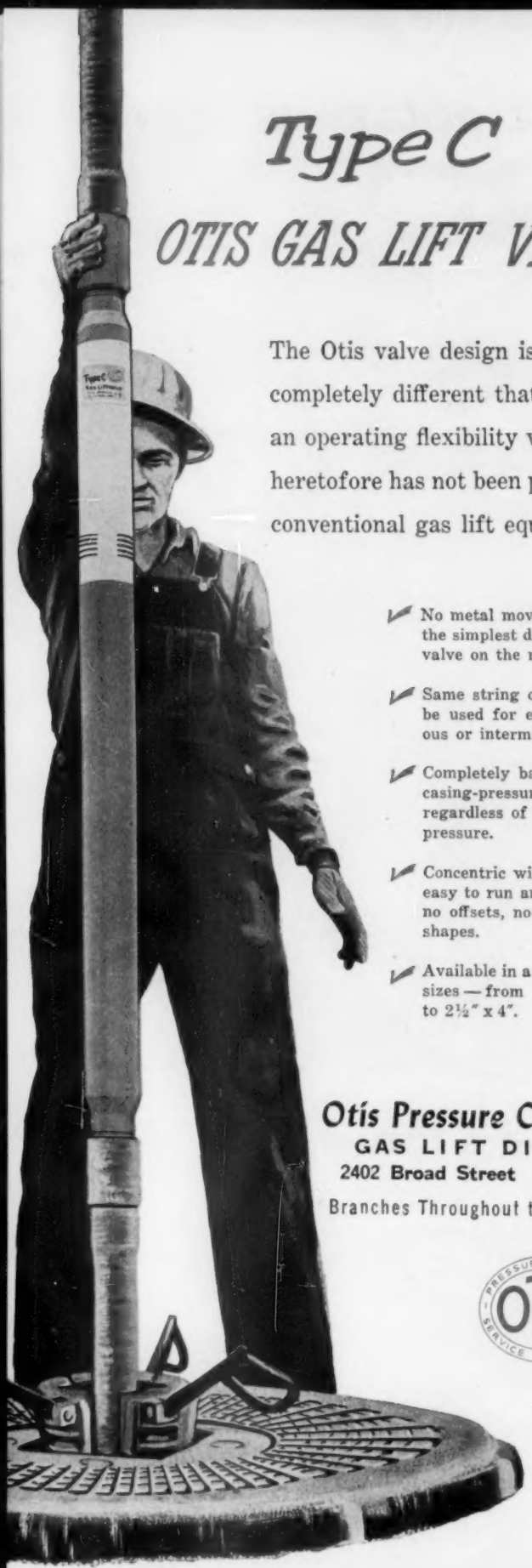
Design is the secret. TORRINGTON Spherical Roller Bearings are made with an integral center flange on the inner race. This assures *positive radial stability and accurate positioning of rollers* wherever high radial load and heavy thrust are encountered under conditions of misalignment.

From crushers to cranes, power shovels to pulverizers, you get long, maintenance-free operation, better performance in your equipment, more value from your bearing dollar when you specify these rugged dependable bearings.

Prove to yourself that TORRINGTON design does make a difference. Next time specify TORRINGTON Spherical Roller Bearings. They're available with either straight or tapered bore, for shaft or adapter mounting.

THE TORRINGTON COMPANY
South Bend 21, Ind. • Torrington, Conn.
District offices and distributors in principal cities of United States and Canada

TORRINGTON BEARINGS
Spherical Roller • Tapered Roller • Cylindrical Roller
Needle • Ball • Needle Rollers



Type C

OTIS GAS LIFT VALVE

The Otis valve design is so completely different that it provides an operating flexibility which heretofore has not been possible with conventional gas lift equipment.

- No metal moving parts . . . the simplest design of any valve on the market today.
- Same string of valves can be used for either continuous or intermittent flow.
- Completely balanced . . . casing-pressure-operated, regardless of tubing pressure.
- Concentric with tubing . . . easy to run and pull . . . no offsets, no unusual shapes.
- Available in a wide range of sizes — from ¾" x 1¾" to 2½" x 4".

Otis Pressure Control, Inc.
GAS LIFT DIVISION
2402 Broad Street • Houston
Branches Throughout the Oil Country

PRESSURE CONTROL — OTIS — SERVICE — EQUIPMENT

Additionally, it devotes a page to Teflon packings, pointing out their advantage and uses. **Write or call: Flexrock Co., 3602-X-Filbert Street, Philadelphia 1, Pa., for folder: Mechanical Packings.**

•

Air Compressors. This new data sheet lists construction details, specifications, and available models of Brunner single and two-stage air compressors in the ¼ to 20-hp. range. The data sheet provides useful data for selecting the right compressor for a specific job. And it describes air outfits for continuous operation. **Write or call: Brunner Manufacturing Co., 11 Fisher Street, Utica, N. Y., for data sheet 653R.**

•

Air Tools Catalog 53 (84 pages) contains descriptions and specifications of 40 basic Thor air tools; their model variations, accessories, and adaptors. The catalog stresses the interchangeability of parts for many tools to guarantee the user the benefits of easy retooling, ready availability of parts, and minimum investment for a wide assortment of tools. **Write or call: Thor Power Tool Co., State and Clain Streets, Aurora, Ill., for Catalog 53.**

•

Stronger Concrete can be obtained with Concretite, according to this new six-page folder. It describes a specially formulated liquid concentrate which, when added to water in the mix, gives extreme compressive strength to concrete or portland cement mortar. And it produces greater hardness and density with more durability, the folder states. A table in the folder compares the compressive strength of plain mortar and mortar using Concretite. And it points out, for different periods of time, the advantages gained with Concretite. **Write or call: Stonhard Co., Inc., 1306 Spring Garden Street, Philadelphia 23, Pa., for folder on Concretite.**

•

Welded Steel Tubing. This new detailed 12-page brochure provides information and helpful technical data on Revere welded-steel tubing. The booklet opens with a general description of the production of welded-steel tubing and then cites a number of advantages claimed for it by the manufacturer. The brochure also includes a comprehensive list of selections of the steel tubing available. It contains size and gage-range charts for such items as round and square-welded, hot-rolled and cold-rolled tubing, and rectangular-

welded hot-rolled and cold-rolled tubing. **Write or call: Revere Copper & Brass, Inc., 230 Park Avenue, New York 17, N. Y., for brochure on welded-steel tubing.**

●

Resistance Thermometer Recorder Data Sheet E-ND 46(7) describes the Speedomax G resistance-thermometer recorder. The two-page data sheet gives examples of applications, such as general calorimetry and determination of purity where an accuracy equivalent to 0.01° C. and a range from —260° to 500° C. is required. The data sheet lists complete specifications and describes the operation of the recorder with the aid of a schematic diagram. It includes specifications of the platinum resistance thermometers used and ordering instructions. **Write or call: Leeds & Northrup Co., 4934 Stenton Avenue, Philadelphia 44, Pa., for Data Sheet E-ND 46(7).**

●

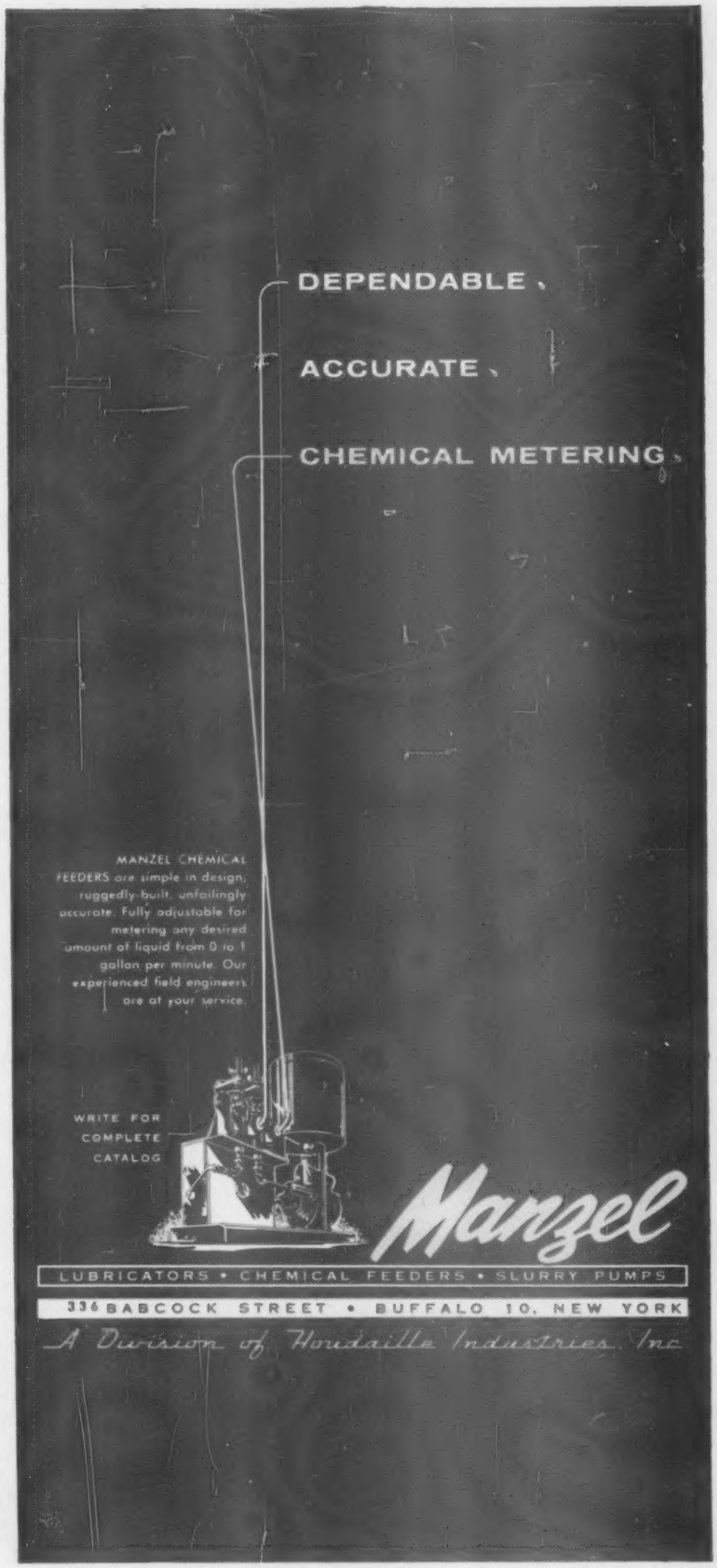
Outboard Propulsion and Steering Units of 40 to 60 hp. and gasoline or diesel powered, are the subject of this new two-page catalog sheet. It illustrates and covers in detail the new Utility Series Harbormasters, which offer most of the advantages of standard Harbormasters at a lower cost. The sheet furnishes illustrations, applications, and a table of specifications. **Write or call: Murray & Tregurtha, Inc., 80 Hancock Street, Quincy 71, Mass., for catalog on Utility Series Harbormasters.**

●

Automatic Controls Catalog. Listing over 100 items, this new catalog describes automatic controls featuring hermetically sealed mercury contacts. The 56-page catalog lists controls for pressure differential pressure, temperature, liquid level, and mechanical movement. It also includes relays and a line of mercury switches. The catalog contains a dual index for locating each control. **Write or call: Mercoid Corp., 4201 Belmont Avenue, Chicago 41, Ill., for Catalog 857.**

●

Self-Sealing Pipe Fitting designed to eliminate pipe-connection leaks is described in this new two-color eight-page brochure. The fitting is threaded on to the pipe and a permanent seal is made with little force or effort. A three-step diagram illustrates how the fitting installs. Text describes its typical uses and applications. **Write or call: True-Seal Div., Flick-Reedy Corp., 2040 North Hawthorne Avenue, Melrose Park, Ill., for brochure on pipe fitting.**


DEPENDABLE,
ACCURATE,
CHEMICAL METERING.
MANZEL CHEMICAL FEEDERS are simple in design, ruggedly built, unfailingly accurate. Fully adjustable for metering any desired amount of liquid from 0 to 1 gallon per minute. Our experienced field engineers are at your service.
WRITE FOR COMPLETE CATALOG
Manzel
LUBRICATORS • CHEMICAL FEEDERS • SLURRY PUMPS
336 BABCOCK STREET • BUFFALO 10, NEW YORK
A Division of Houdaille Industries, Inc.

THE
AERO
COMMANDER

SPREADS ITS WINGS

IN THE NEW 560-E

This newest AERO COMMANDER provides the long range comfort and high speed performance demanded by today's busy, "on-the-go" Executive.

The COMMANDER's soaring, extended wing span teamed with new, powerful Lycoming High Compression Engines stands ready to whisk the flying Executive farther and faster . . . covering the miles coast-to-coast with but one stop.

The versatility of the AERO COMMANDER 560-E makes the necessity of long concrete runways a thing of the past.

As the latest member of the COMMANDER business fleet, this new long-range model incorporates advances in aircraft engineering coupled with the peak performance, beauty, and comfort that has made AERO COMMANDERS the most preferred executive aircraft in the industry today.

To obtain complete information concerning the 560-E or any of the 5 to 7 passenger business fleet AERO COMMANDERS . . . write or wire, AERO DESIGN & ENGINEERING CO, Box 118, Bethany, Oklahoma.

Those who know aircraft best fly COMMANDERS

AERO Commander

AERO DESIGN & ENGINEERING CO

EQUIPMENT MEN . . . in the News

BJ Service Executives Hold Meeting in Long Beach

The management of BJ Service, Inc., recently held a sales and operations meeting at the Long Beach, Calif., general office. Featured at the meeting were plans for the enlarged operation resulting from the recent addition of Chemical Process as a division of BJ Service.

Participating in the meeting were: Curt Cross, Texas division manager; Jim Gardner, Texas division sales supervisor; C. Z. Hughes, Rocky Mountain division manager; W. T. Box, vice president in charge of operations; C. Marshall, personnel manager; James T. Streger, Pacific Coast division manager; R. P. Kirkpatrick, district superintendent, Glendive, Mont.; Frank D. Smith, vice president, sales; and R. Wilkinson, executive assistant.

Homco Makes Personnel Changes, Promotions

J. W. (Mutt) Caskey has been named assistant division manager at Casper, Wyo., for Houston Oil Field Material Co., Inc. E. W. Konnerup, store manager at Kimball, Neb., is now district manager of Kimball, Casper and Billings with headquarters in Casper. Bill Baker, former field salesman, is store manager at Kimball.

New resident manager at Edmonton, Alta., Canada, is Paul Mentzel, advanced from field salesman at Billings, Mont. Also newly stationed in Billings is Donald Carlson, field salesman.

District manager over the San Juan-Paradox basins with headquarters in Farmington, N. M., is W. S. George. George, former store manager at Farmington, was replaced there by Dewey Watkins. Named city salesman in Denver was Lowell Harris, formerly field salesman at Farmington.

Hutchison Manufacturing Names Smith as President

J. E. SMITH

J. E. Smith, vice president of Johnston Testers in Houston since 1951, has been named president of Hutchison Manufacturing Co. of Houston, it has been announced by F. E. Hutchison. The latter organized the Hutchison company 20 years ago and will be chairman of the board in the new management setup.

Hutchison manufactures and markets drilling-rig equipment, its chief line being shale shakers, desanders, and rig-lighting systems.

Smith became associated with Johnston in 1938 when the testing company purchased Gas Lift Corp. He has been sales manager since 1951 when he was named a vice president of sales and engineering. His title was changed to vice president of sales and advertising in 1953.

Oilwell Appoints Evans, Jenkins, and Blunderfield

The appointment of Garth V. Evans as field representative at Drayton Valley, Alta., Canada, for United States Steel Corp.'s Oil Well Supply Division

Baash-Ross Holds Houston Sales Meet

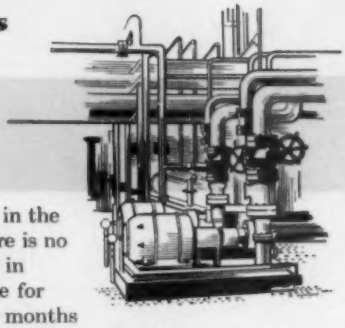
Under the direction of H. L. Messinger, general sales manager, sales executives of Baash-Ross Tool Co., division of Joy Manufacturing Co., met for 2 days to discuss ways to improve service and products to the oil industry. The following personnel attended: (seated) E. R. Lindgren, chief engineer; Messinger; Glenn D. Johnson, vice president and general manager; E. M. Gearke, regional sales manager, all of Houston; and Robert L. LeBus, Jr., export manager, New York City.

Standing: Leo Cypher, special sales representative, Houston; Gene A. Maxwell, area engineer, Los Angeles; E. W. Carne, Jr., Caribbean sales and service representative; Gordon A. Morrison, area sales manager, Edmonton, Alta., Canada; Donald Cook, power swivel product manager, Ventura, Calif.; R. C. Brenner, city sales, Dallas; Curtis Atkins, area sales manager, Mexico, D. F.; Thomas Ray, Jr., area sales manager, Oklahoma City; H. C. Mays, area sales manager, Odessa; Bobby G. Prichard, city sales, Tulsa; Glenn R. Huckabay, division sales manager, New Iberia, La.; Albert E. Schoettler, general sales office supervisor, Houston; Herbert H. Klepfer, area sales manager, Los Angeles; R. W. Westerman, area sales, Olney, Ill.; and S. Gerald Fuex, manager, advertising and sales promotion.

Positive Proof...

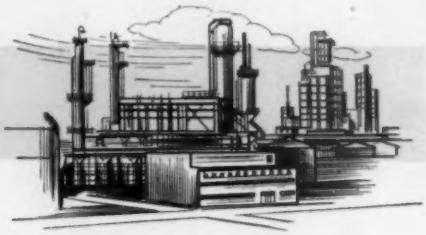
The John Crane® Type 9 Shaft Seal Solves Those Tough Liquid Handling Problems

Actual Field Reports



✓ from an Arkansas Refining Plant

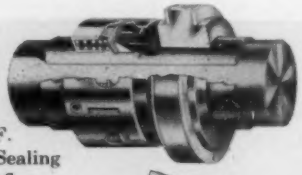
When it comes to avoiding trouble in the handling of naphtha at 420°F., there is no substitute for positive sealing. And in cases like this there is no substitute for "John Crane's" Type 9 Seal. Many months of completely satisfactory operation offers convincing proof.



✓ from a Louisiana Refinery

It takes a "lot of shaft seal" to handle a highly corrosive mixture such as an emulsion of sulphuric acid and butane. This stuff plays real havoc with metals due to its corrosive action. Despite this, Type 9 Seals on twenty seven pumps are pumping month after month in continuous service. At this same location, other Type 9's are effectively handling "fresh" sulphuric acid at the high suction pressure of 400 psi.

In cases like these . . . and in those confronting you . . . the surest answer is the "John Crane" Type 9 Seal.

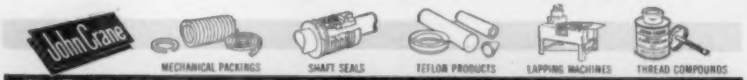


CONDENSED SPECIFICATIONS

Recommended services: all industrial chemicals, corrosives, liquids or gases. Temperatures: −120°F. to +500°F. Pressures: up to 750 psi. Construction: Sealing members of chemically inert DuPont Teflon, metallurgy best suited to service requirements.

Send us your problems. Request Bulletin S-205-2.

Crane Packing Company, 6419 Oakton Street, Morton Grove, Illinois, (Chicago Suburb).
In Canada: Crane Packing Co., Ltd., Hamilton, Ont.



CRANE PACKING COMPANY

has been announced by W. A. Weir, Canadian area manager. James F. Jenkins, store manager, has been transferred from Okotoks, Alta., to Drayton Valley. Angus F. Blunderfield has been appointed store manager at Okotoks.

Evans was employed by Oilwell in 1949 at Edmonton, Alta. In 1952 he was appointed field representative at Edmonton and in 1956 was named store manager there. Jenkins joined Oilwell in 1948. He has served as store manager at Swift Current and Okotoks. Blunderfied has served Oilwell at the Okotoks store and at Calgary, Alta.

Morris Heads New Houston Office of Drilco Oil Tools

Drilco Oil Tools, Inc., Midland, Tex., has opened a sales office in Houston with Don Morris in charge. Drilco is primarily a manufacturer of drill collars.

Drilco presently operates machine shops in Midland and Snyder and has pipe-inspection and service points in Odessa and Hobbs, N. M.

Morris has been with Drilco since its organization in 1953 and until the new appointment was district field salesman in West Texas.

Schlumberger Appoints Managers, Engineers

R. L. MORRIS

The appointment of R. L. Morris as manager of the expanded North Louisiana division, which now includes the field offices of Mississippi in addition to those of northern Louisiana and southern Arkansas, has been announced by Schlumberger Well Surveying Corp.

The new manager of Schlumberger's district in Great Bend, Kans., is J. D. Austin while J. L. Hallman assumes that position for the company's perforating location at Farmington, N. M.

New division engineers are H. D. Babock for the Kansas division at Wichita and R. L. Madden for the Texas Gulf Coast division in Houston.

The following have assumed Schlumberger sales positions: B. L. Delleney at Dallas; H. Millican, Midland; W. D. Baker, Evansville, Ind.; C. H. Blackburn, Alice, Tex.; N. Montgomery,

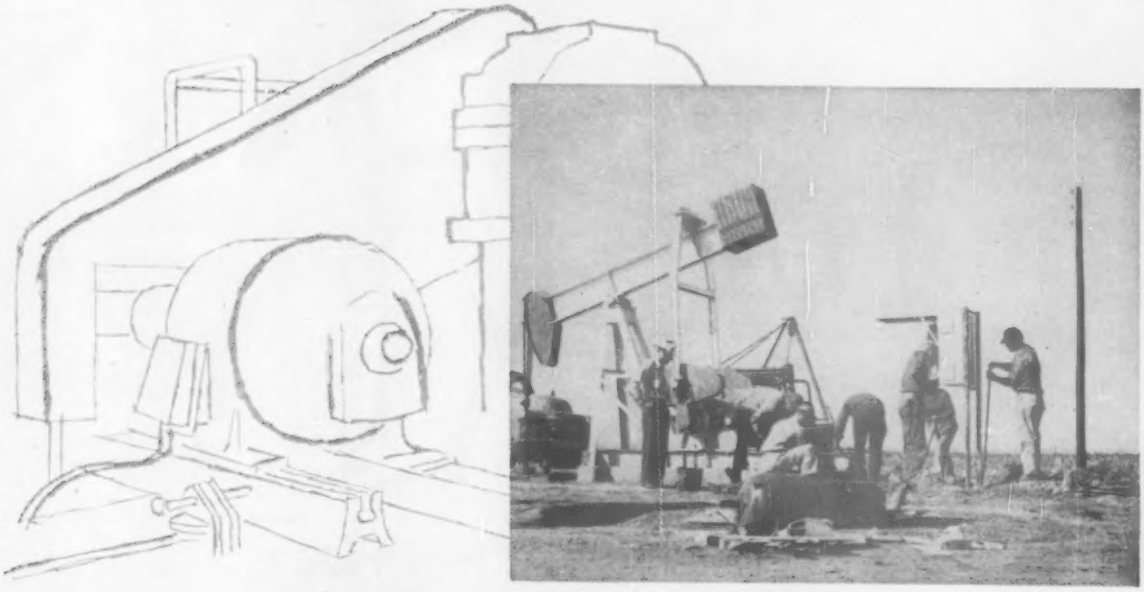
everywhere . . . the change is to

low cost ELECTRIC power . . .

WHY? Because the greatest value today *is* Electric Power — Low Cost Purchased Electric Power. In the face of ever increasing costs, Electric Power has remained at extremely low rates.

Today, your Utility Electric Power Company offers even greater service at a lower cost than ever before! ECONOMY — *PEP cuts down installation, operating, mainteance, and labor costs! CONVENIENCE — With PEP you have constant, dependable service, automatic controls, and a more satisfactory trouble-free operation. Yes, everywhere . . . the change is to low cost Electric Power . . .

**Purchased Electric Power*



Above an actual switch is being made to Electric Power.

Call your power company for details on how *PEP can serve you.

PETROLEUM ELECTRIC POWER ASSOCIATION

P. O. Box 2771, Dallas, Texas

NO ACHILLES HEEL

From the sad story of Achilles, who was protected completely except for his heel, comes a valid moral. Protection to be completely effective must be total. Since 1939, Tube-Kote has been perfecting coatings and the techniques of their application to make positive protection. You can be certain of a thorough job, with no Achilles heel, when you specify Tube-Kote for corrosion protection.

TUBE-KOTE

SERVICE MARK REG. U. S. PAT. OFF.

PREVENT CORROSION,

Paraffin Deposits on Tubing, Casing, Drill Pipe, Line Pipe, and Sucker Rods

TK-2 is the only baked-on plastic lining obtainable which is backed by the company that developed and pioneered the use of plastic linings for oil field tubular goods and well equipment. No other type plastic can match the exceptional quality you get with TK-2 linings.

TK-2 is Tube-Kote's exclusive formula for phenol-formaldehyde plastic resin – the only type of plastic being used to line oil field equipment that positively will not soften under elevated temperatures. This means that TK-2 maintains its high degree of resistance to abrasion and tool gouging throughout any range of working temperatures. Such resistance to damage is not possible with air-dried or ordinary baked coating.

TK-2 STANDARD KOTE – TO COMBAT CORROSION. This is a lining that resists both corrosion damage and paraffin deposition.

TK-2 SPECIAL KOTE – TO COMBAT PARAFFIN DEPOSITION. This is an application to prevent paraffin accumulation, although it is not recommended for anti-corrosion use.

Enlarged cross-section of metal which has been coated with TK-2. This shows the close bond that exists between TK-2 and the metal surface. Because of its composition and the unique method of application, TK-2 flows into the most minute surface irregularities. When the final bake is completed, the multiple-layers of plastic coating become fused into an exceptionally strong mirror-smooth finish.

Tube-Kote
INCORPORATED
2727 HOLMES ROAD
P. O. BOX 20037
HOUSTON, TEXAS

Evansville, Ind.; B. C. Knarr, Farmington; D. Carlin, Liberal, Kans.; G. M. Lehnertz, Tyler, Tex.; J. A. Masters, Big Lake, Tex.; and A. H. Jageler, Hobbs, N. M.

Schramm Opens Division Headed by McLaughlin

Schramm, Inc., West Chester, Pa., has opened an oil-field division in Dallas to concentrate the company's engineering, sales, and service operations in the oil country. The division will function as a separate branch of the parent company but will utilize and coordinate some of the firm's existing dealer and sales-organization facilities.

The new division is headed by Philip L. McLaughlin, a former executive of Cardwell Manufacturing Co. in Wichita, Kans.

Additional research will be carried on from the new Dallas facility, including studies for a broader application of compressor and booster equipment in the producing, petroleum refining, chemical, and pipeline divisions of the oil industry.

T. E. Mercer Trucking Co. Opens New Odessa Terminal

T. E. Mercer Trucking Co. has opened its newest truck terminal and storage yard just east of the Odessa city limits, according to Tommy G. Mercer, president of the firm. The establishment of the new terminal to better serve the West Texas and New Mexico oil-field activity marks the seventh in the firm's network of terminals. The operation will be handled by R. M. Hendricks, terminal manager, and his assistant, Randall McGee. They will work closely with the West Texas solicitor, Chuck White.

HENDRICKS

RANDALL McGEE

The original founder of the firm, T. E. Mercer, managed the organization from 1910 to 1930. From 1945 until 1953, the son, George E. Mercer, managed the business. The management of the organization has been in the hands of the third generation, Tommy G. Mercer, since 1955.

With a fleet of more than 200 trucks, 49 supervisors' cars, several caterpillars, tractors, bull graders, heavy

Built for Men Who Know
WHAT IT TAKES

WICHTEX
Well Servicing Units

ENGINEERED
for simplified operation and upkeep

RUGGED
for long trouble-free life

REASONABLY PRICED
for fast payout

Models range from 2,000-foot to 12,000-foot capacity.

WRITE FOR NEW CATALOG NOW

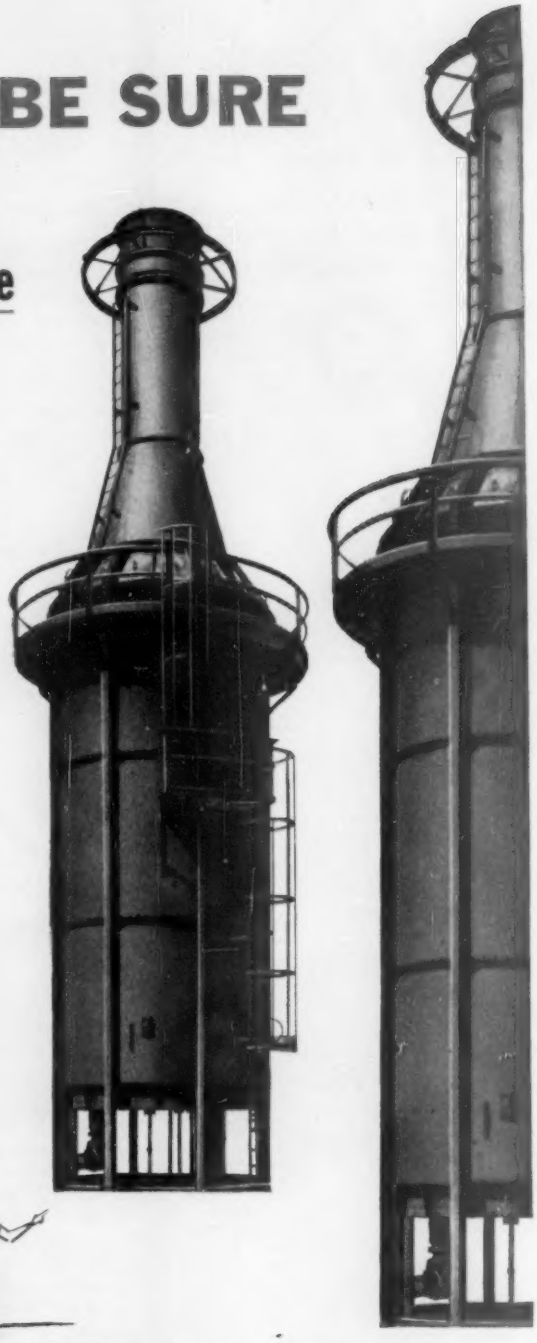
WICHTEX MACHINERY COMPANY INC.
WICHITA FALLS TEXAS
Box 2250 Ph. 2-8612

YOU, too, CAN BE SURE

petrochem-isoflow furnaces

are most economically desirable

by any comparison



Whenever *all* the specifications and *all* the operating requirements are applied to direct-fired furnace design, you can be sure PETROCHEM-ISOFLOW FURNACES will be found most economically desirable, by any comparison.

In making comparisons it is essential to take these factors into consideration:

1—Average radiant transfer rate.
2—Maximum deviation from average radiant transfer rate.
3—Average and maximum transfer rate in convection section.
4—Maximum tube wall temperature, radiant or convection.
5—Maximum efficiency with specified excess air.
6—Controlled thermal recirculation of flue gases to provide even heat distribution throughout full length of each tube and equalized heat distribution around each tube.
7—Overload and corresponding transfer load.
8—Design to provide: structural column supports—Ladders—Platforms—Tube Removal facilities, etc.
9—Degree of assembly; of the furnace structure and of the heating surface.

When you specify PETROCHEM-ISOFLOW FURNACES . . . you'll be in good company. More than 1500 are now in service, performing to the complete satisfaction of their operators and usually well beyond their rated capacities.

PETROCHEM-ISOFLOW FURNACES

UNLIMITED IN SIZE . . . CAPACITY . . . DUTY

PETRO-CHEM DEVELOPMENT CO., INC. • 122 EAST 42nd St., New York 17, N. Y.

REPRESENTATIVES:

Rawson & Co., *Houston* • Wm. H. Mason Co., *Tulsa* • Lester Oberholtz, *Los Angeles* • Faville-Levally, *Chicago* • D. D. Foster, *Pittsburgh* • Turbex, *Philadelphia* • Flagg, Brackett & Durgin, *Boston* • G. M. Wallace & Co., *Denver & Salt Lake City*

International Licensees and Representatives: SETEA–S.A. Comercial, Industrial, y de Estudios Tecnicos, Buenos Aires, Argentine • Industrial Proveedora, Caracas, Venezuela • Societe Anonyme Huertey, Paris, France • Societe Anonyme Belge, Liege, Belgium • Huertey Italiana S.P.A., Milan, Italy • Birwelco Ltd., Birmingham, England

winches, mud boats and other equipment, the firm serves customers in 15 states: Texas, Louisiana, Mississippi, Oklahoma, Kansas, Tennessee, Arkansas, Florida, Georgia, Alabama, New Mexico, Colorado, Wyoming, Montana, and Utah.

Robinson Appointed Mgr. Of Middle West Coating

Joe R. Robinson has been appointed manager of Middle West Coating & Supply with offices in the Daniel Building, Tulsa. Middle West is a distributor of pipeline protection and other equipment.

Robinson was with the pipeline engineering and personnel departments of Panhandle Eastern Pipe Line Co. in Kansas City for 4 years. From 1951 until he joined Middle West, he was Chicago area sales representative for Pittsburgh Coke & Chemical Co.

Field Sales Personnel Are Shifted by J & L Supply

J & L sales representatives Cecil J. Kriewitz, Lester L. Reed, and Eldon J. Pierson have been assigned to Denver, Colo.; Glendive, Mont.; and Perryton, Tex., respectively, according to W. L. Wolfe, vice president of sales for Jones & Laughlin Supply Division, Tulsa. In the firm's Canadian operations, John A. Lineham, formerly a storeman at Drayton Valley, Alta., has been promoted to sales representative to serve the Edmonton, Alta., area.

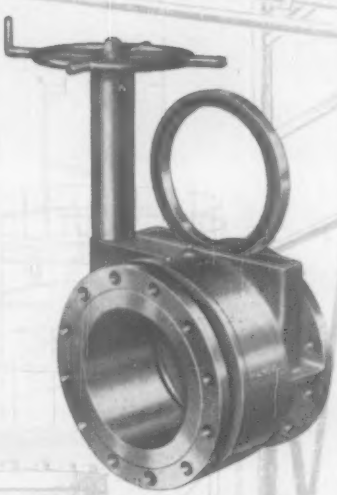
Jack E. Chestnut, formerly serving the Graham, Tex., area since 1954, has been transferred to J & L's Dallas sales office; and Frank E. Vanderbilt has been assigned as sales representative at Graham.

Kriewitz joined J & L in 1951 as a storeman and in 1953 was promoted to manager of the Glendive store and in 1955 was made a salesman at that location. Reed started as a storeman in 1951. Advanced to salesman in 1953, he served at Newcastle, Wyo., until his recent transfer to Glendive.

Pierson became associated with J & L in 1952. Since then he has served as a storeman at El Dorado and Chase, Kans., and as a salesman at Great Bend, Kans. Lineham entered the firm's employ as a storeman at Edmonton, Alta., in 1954 and in 1955 was transferred to Drayton Valley where he served as a storeman until his recent promotion.

Chestnut joined J & L in 1953 and

PUTTING THE "ABSOLUTE" IN LINE SHUT-OFF...



Hamer Line Blind Valves

It has long been recognized that conventional type valves do develop leaks. And contamination of product when it occurs costs dearly in time and money. Preventing this is where Hamer Line Blinds excel. Handwheel or bar operated, Hamer Line Blind Valves squeeze dead tight against the center spectacle plate forming an impassable line shut-off that's both permanent and absolute. Yet Hamer Line Blinds are fast, safe, simple to operate. One man can open or blind a line in one minute. Investigate Hamer Line Blinds. Let a Hamer representative show you how these remarkable valves can actually pay for themselves.

SEND FOR FREE CATALOG

OTHER FINE HAMER VALVES

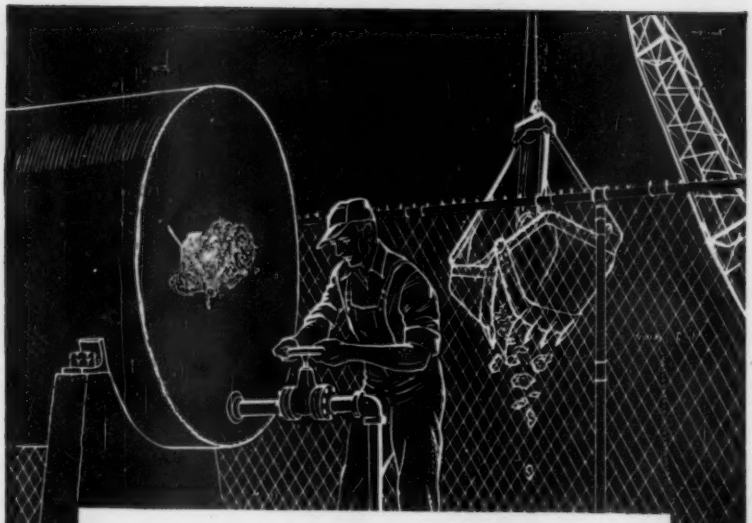
Leak-proof Gate Valve

Visible Wedge Valve

Lift-type Plug Valve

Hamer VALVES INC.

P. O. Box 1851
2919 Gardenia Ave., Long Beach 1, Calif.
Representatives throughout the World



A new plant next door can increase FIRE HAZARD on your side of the fence!

As industrial areas grow more crowded, the need for complete fire protection mounts. To the normal hazards in your own plant must be added those of new neighbors. Be sure that your flammable liquids are protected! Ask for specialized suggestions from National Foam.

NATIONAL FOAM System, Inc.
West Chester, Pa.

NATIONAL FOAM FIRE PROTECTION SYSTEM

The only company exclusively engaged in the design, development and manufacture of foam fire protection equipment and chemicals.

served as storeman at Pleasanton, Tex., until his promotion to salesman and transfer to Graham. Vanderbilt has been with J & L since 1955, when he joined the general sales staff. After working at the Beaumont, Tex., store, he was transferred to Pleasanton, remaining there until his present promotion.

Denver National Bank Elects Cosgriff President

S. COSGRIFF

Stewart Gosgriff has been elected president of The Denver National Bank, succeeding Henry A. Kugeler, who was elevated to chairman of the board.

Cosgriff has been vice president of the bank since 1948. Prior to joining Denver National, Cosgriff was vice president of the then First National Bank of Salt Lake City, Utah. His father, John B. Cosgriff, and an uncle, Thomas A. Cosgriff, were founders of the Hamilton National Bank, since merged into the Denver National.

Kugeler, who joined the Denver National as cashier in 1944 and became president in 1946, will remain as an active officer of the bank. He is the bank's first board chairman since the retirement of Henry C. Van Schaack in 1948.

Also sharing promotion honors were E. L. Harrison, assistant cashier, elected assistant vice president, and Charles V. Crockett, appointed assistant cashier. Harrison joined the Denver National in August 1955, transferring from the National Bank & Trust Co. of South Bend, Ind., where he was assistant vice president. Crockett started with the Denver National as a runner in 1934.

Lane-Wells Personnel Changes Are Announced

The Tulsa sales office of Lane-Wells Co. has new quarters in the Enterprise Building. S. W. McGaha and J. D. Cruce will be the representatives in the new location. J. F. Alexander was transferred recently to the Farmington, N. M., district as district manager. Carl W. Combs will assume the duties of assistant district manager in Farmington. E. L. Thomason will become Lane-Wells Seminole area manager.

Lane-Wells' southern Louisiana district office in New Orleans has been reclassified as a Gulf Coast division sales office and will be headed by Dean R. Hoffman. O. J. Guseman has been

A Parkersburg Hyreco's **LIQUID**

KNOCKOUT PUNCH

means more profits in cold separation

Operators like the savings in maintenance costs when they produce through a Hyreco cold separation unit. These savings are possible because Parkersburg's exclusive vertical type liquid knockouts completely remove water and waste from the well stream before it enters the high pressure separator. This adds up to a three-way savings:

1. **LESS LABOR COST.** Convenient clean-out ports make Parkersburg vertical knockouts easier to clean, a real savings in man hours.
2. **LESS LOSS OF WELL PRODUCTION TIME.** Your well produces more hours through a Hyreco because less time is required for cleaning out the unit.
3. **LESS LOSS OF MARKETABLE GAS** used to blow out accumulated mud and other foreign matter.

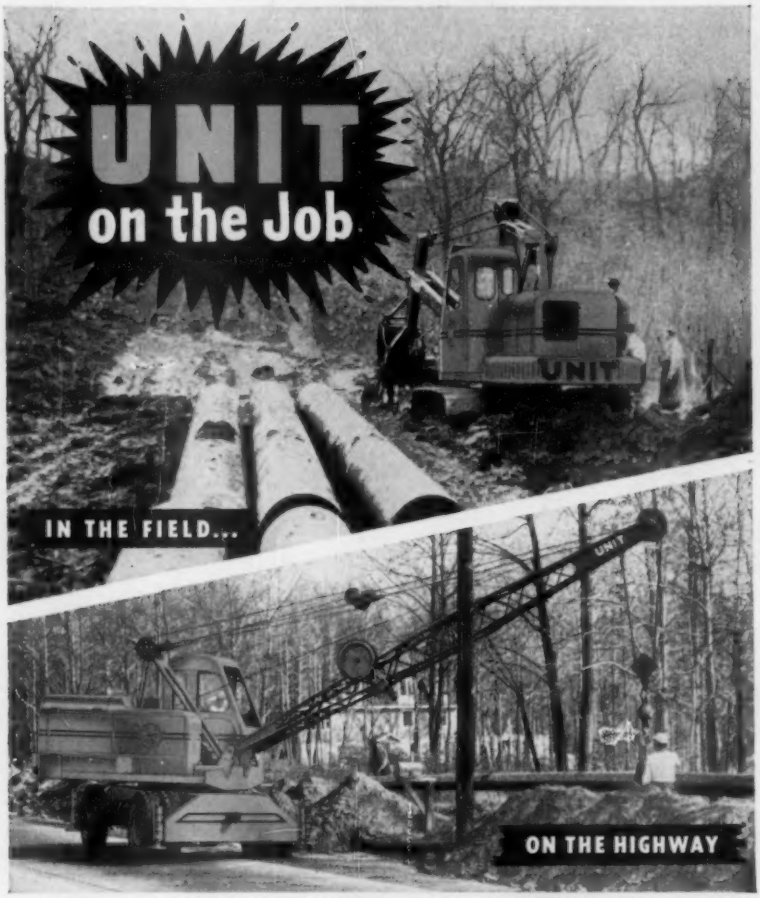
Parkersburg's exclusive vertical type liquid knockouts is another reason why a Hyreco cold separation unit gives better operating efficiency and more economy.

At Parkersburg, quality and service have gone hand-in-hand for 60 years.

Parkersburg
RIG AND REEL COMPANY
DIVISION OF PARKERSBURG : AETNA CORPORATION

3345 WINTHROP AVENUE
FORT WORTH 16, TEXAS

PESA



Where Pipeline Goes...UNIT Goes!

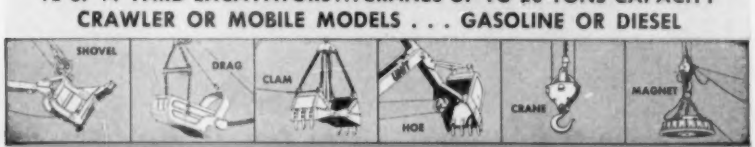
In the field where the going is tough, UNIT TRENCHOES have the traction and power for continuous ditching to meet pipeline schedules. For laying pipeline along the right-of-way, where the going is smooth, the self-propelled mobile UNIT offers road travel speed, plus accurate lift and swing control. Designed for speed and stability, UNIT crawler and mobile equipment are built to meet every trenching and handling job required in pipeline construction work.

SEE FOR YOURSELF: *Let us send you our novel TV Brochure. It illustrates the complete UNIT line.*

UNIT CRANE & SHOVEL CORPORATION
6327 WEST BURNHAM STREET • MILWAUKEE 14, WISCONSIN, U. S. A.

UNIT

½ or ¾ YARD EXCAVATORS...CRANES UP TO 20 TONS CAPACITY
CRAWLER OR MOBILE MODELS . . . GASOLINE OR DIESEL



All Models Convertible to ALL Attachments!

A 7187-2/3-C

reclassified as assistant manager of field services with headquarters in Houston.

Lee Moses transferred from Refugio in the Southwest Texas district to Magnolia, Arklatex district, and was reclassified to area manager at that base. W. J. Anderlohr was transferred from Corpus Christi to Refugio and named operator-in-charge of that base.

H. E. Powell, senior division mechanical engineer at Oklahoma City, has transferred to head office engineering, Houston. Jesse Smith, assistant to chief logging engineer, has transferred to head office engineering, Los Angeles. M. P. O'Haver, assistant manager of field services, moved from Denver to division headquarters in Oklahoma City. Ira Hahn, division mechanical engineer at Oklahoma City, has retired from the company.

Vern D. Hilterbran, station manager at Farmington, N. M., has been promoted to field service operating engineer; W. H. Guinty promoted from assistant district manager to manager of the Illinois district; Harley C. Hanselman promoted to district sales engineer trainee and transferred to Perry, Okla.

E. O. Molitor will be promoted and transferred to Seminole, Okla., as area manager; S. W. Crain will transfer to Casper, Wyo., as district manager. Russell A. Nelson is being reclassified to Rocky Mountain district logging and mechanical engineer.

N. S. Kimball was transferred from Hobbs, N. M., to Alice, Tex., and reclassified to district sales engineer.

Crane Carrier Corp. Buys Available Truck Co.

The Available Truck Co. of Chicago, manufacturers of heavy-duty trucks, has been purchased by Crane Carrier Corp., Tulsa, Robert L. Zeligson, president of Crane Carrier, recently announced. The Available Truck Co. will be operated as a division of Crane Carrier.

Crane Carrier Corp. is a subsidiary of Standard Industries, Inc., of Pennsylvania.

Axelson Appoints Three to Hydraulic Sales, Service

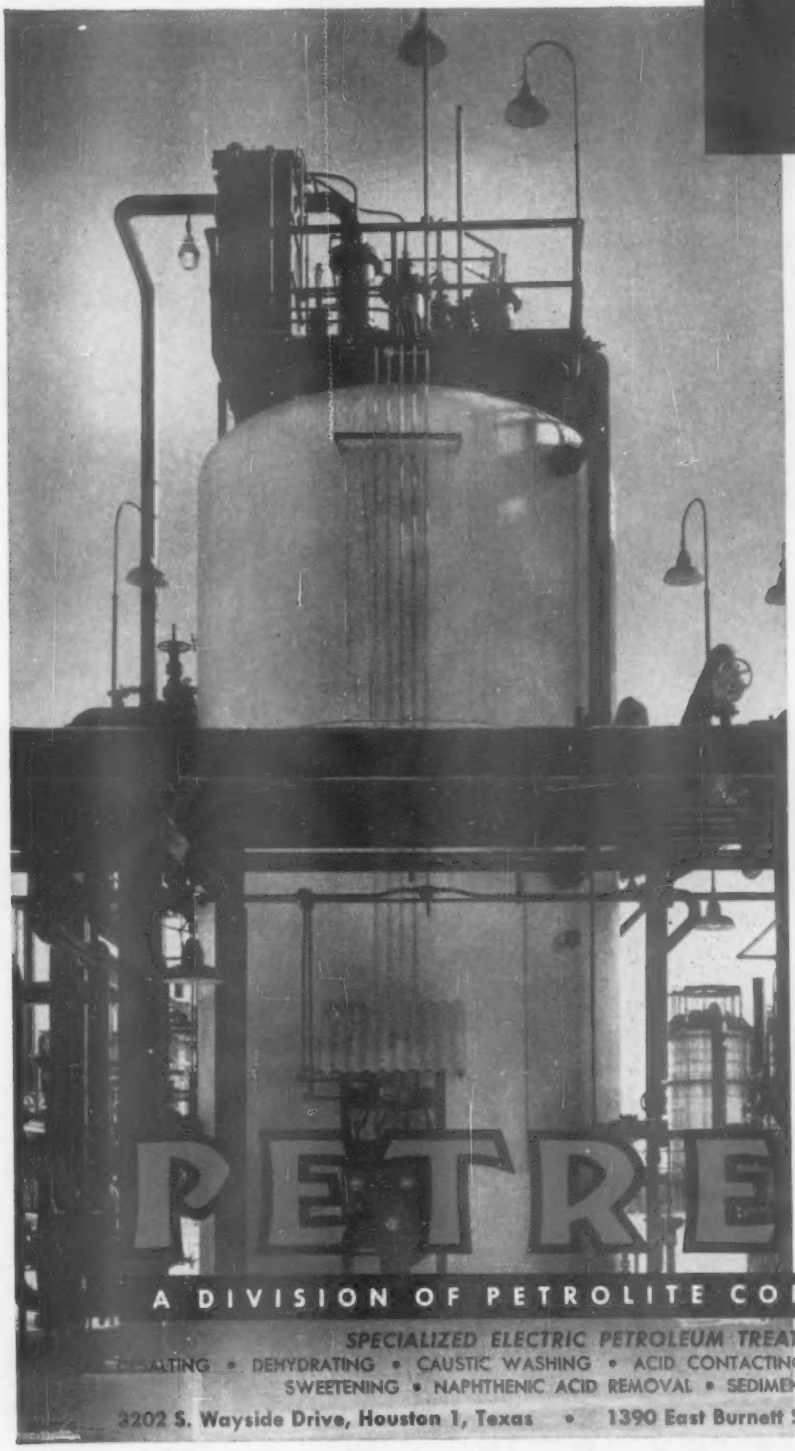
The appointment of O. G. Goodwin as sales representative for the Rocky Mountain area has been announced by J. W. Rockwell, sales manager for hydraulic units, Axelson Manufacturing Co., division of U. S. Industries, Inc. Goodwin will be located in Casper, Wyo.

George Browning and C. D. Dacus have joined the hydraulic service section of Axelson. Browning has been assigned the northern Texas area, with

YOU CAN SAVE UP TO 70%...

ON INSTALLATION COSTS

if you
- Caustic Wash
- Acid Treat
- Doctor Treat
- Water Wash
- Remove Nitrogen & Arsenic



by installing PETRECO ELECTROFINING

Petreco Electrofining equipment can easily save you up to 70% on installation. The reasons are readily apparent: it's a once-through, single unit installation that requires fewer pumps, less piping, smaller area.

...and also save on operating costs

because it's a continuous, automatic process in which the distillate is contacted with exactly the *right amount* of treating agent, in the *correct intensity* for the proper time. The result is a clean separation of hydrocarbon and chemical agent, with a minimum carry-over and product loss.

WE'D LIKE TO TELL YOU MORE

about the Petreco Electrofining Process ... and we do in our new Bulletin. Write for your free copy.

PETRECO®

A DIVISION OF PETROLITE CORPORATION

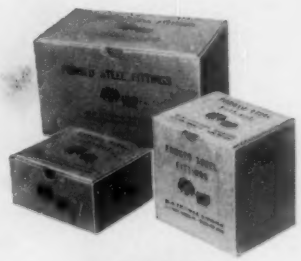
SPECIALIZED ELECTRIC PETROLEUM TREATING

DESALTING • DEHYDRATING • CAUSTIC WASHING • ACID CONTACTING • DOCTOR TREATING
SWEETENING • NAPHTHENIC ACID REMOVAL • SEDIMENT REMOVAL

3202 S. Wayside Drive, Houston 1, Texas • 1390 East Burnett St., Long Beach 7, California

NOW *a Modern Fittings Package*

one more reason for specifying
W-S FORGED STEEL FITTINGS



W-S Forged Steel Fittings are now being shipped in strong, lightweight fiberboard cartons designed to make purchasing a pleasure. Shipments are made up of unit cartons packaged inside a larger reinforced carton. It's easy... and advantageous to order your fittings in packaged quantities.

Here are additional advantages of the new W-S package:

1. Compact and easy to handle.
2. Ideal for neat, efficient stacking on warehouse and stockroom shelves.
3. Sealed against dust and moisture.
4. Contents clearly marked on outside face of each carton, readily visible for prompt identification.

The new W-S package is only one of many reasons why W-S Forged Steel Fittings are the most widely accepted by industry.

Don't forget, too, W-S carbon steel fittings have the additional protection of their new blue synthetic coating. For detailed information on packaged lots ...and for a copy of our new fittings catalog, write today to W-S Fittings Division, H. K. Porter Company, Inc., Roselle, N. J.

Sold Through Leading Distributors

HKP W-S FITTINGS DIVISION
H. K. PORTER COMPANY, INC.

headquarters in Wichita Falls, and Dacus the Oklahoma area with headquarters in Oklahoma City.

Ever-Tite Enlarges In Twenty-Fifth Year

Ever-Tite Coupling Co., New York City, is celebrating its twenty-fifth anniversary as a manufacturer of quick

J. T. KRAPP

J. BUCHANAN

hose couplings and other fittings for the petroleum and chemical industries.

In its twenty-fifth year, according to John T. Krapp, president, Ever-Tite is completing its second expansion program within the last 3 years. This last enlargement consisted largely of office space to accommodate the increased staff required for greater production.

James Buchanan, sales manager of Ever-Tite, has reported several additions to the sales and office staff the last 6 months.

Lumpkin Is Appointed to Girdler Catalyst Staff

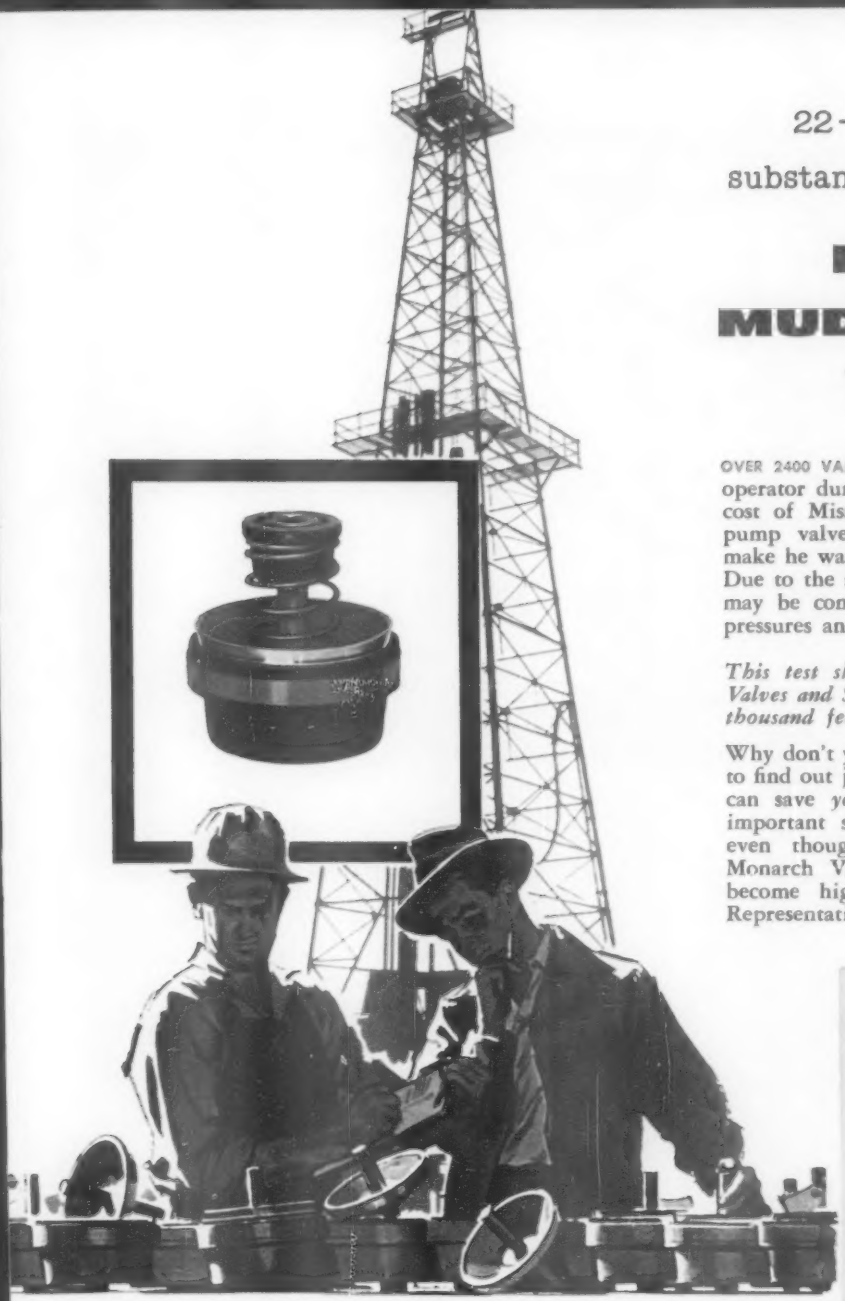
W. Doss Lumpkin has joined the catalyst department of The Girdler Co., Louisville, Ky. He will specialize in the marketing of catalysts employed in the processing of fats and oils, and in the hydrosulfurization and treating of petroleum feed stocks. The announcement was made by Dr. Ronald E. Reitmeier, manager of the department.

Lumpkin previously was with Phillips Petroleum Co. and Filtrol Corp. He joined Girdler's Votator division in 1954 and was assigned to the sale of catalysts used in the fatty oils industry.

Weston Appoints Schlegel And Hemion to Sales Posts

The appointment of Russel A. Schlegel as general sales manager and John R. Hemion as assistant to the general sales manager has been announced by W. H. Steinkamp, vice president in charge of sales of Weston Electrical Instrument Corp., Newark, N. J. Weston is a subsidiary of Daystrom, Inc.

Schlegel will supervise and coordi-



22-month test showed substantial savings from using

MISSION MUD MONARCH VALVES

OVER 2400 VALVES AND SEATS were used by a large operator during a 22-month test comparing the cost of Mission Mud Monarch fluid end mud pump valves and seats with the competitive make he was using at the beginning of the test. Due to the size and duration of the test, results may be considered conclusive for the 2500-psi pressures and other conditions encountered.

This test showed that Mission Mud Monarch Valves and Seats cost less than half as much per thousand feet of hole as the competitive make.

Why don't you make a competitive test yourself to find out just *how much* Mud Monarch Valves can save *you?* Many operators have reported important savings at normal pump pressures, even though the advantage of using Mud Monarch Valves becomes greater as pressures become higher. Arrange with your Mission Representative for a competitive test.

COMPETITIVE VALVES

cost more than $36 per thousand feet of hole.

MUD MONARCH VALVES

cost less than $18 per thousand feet of hole!

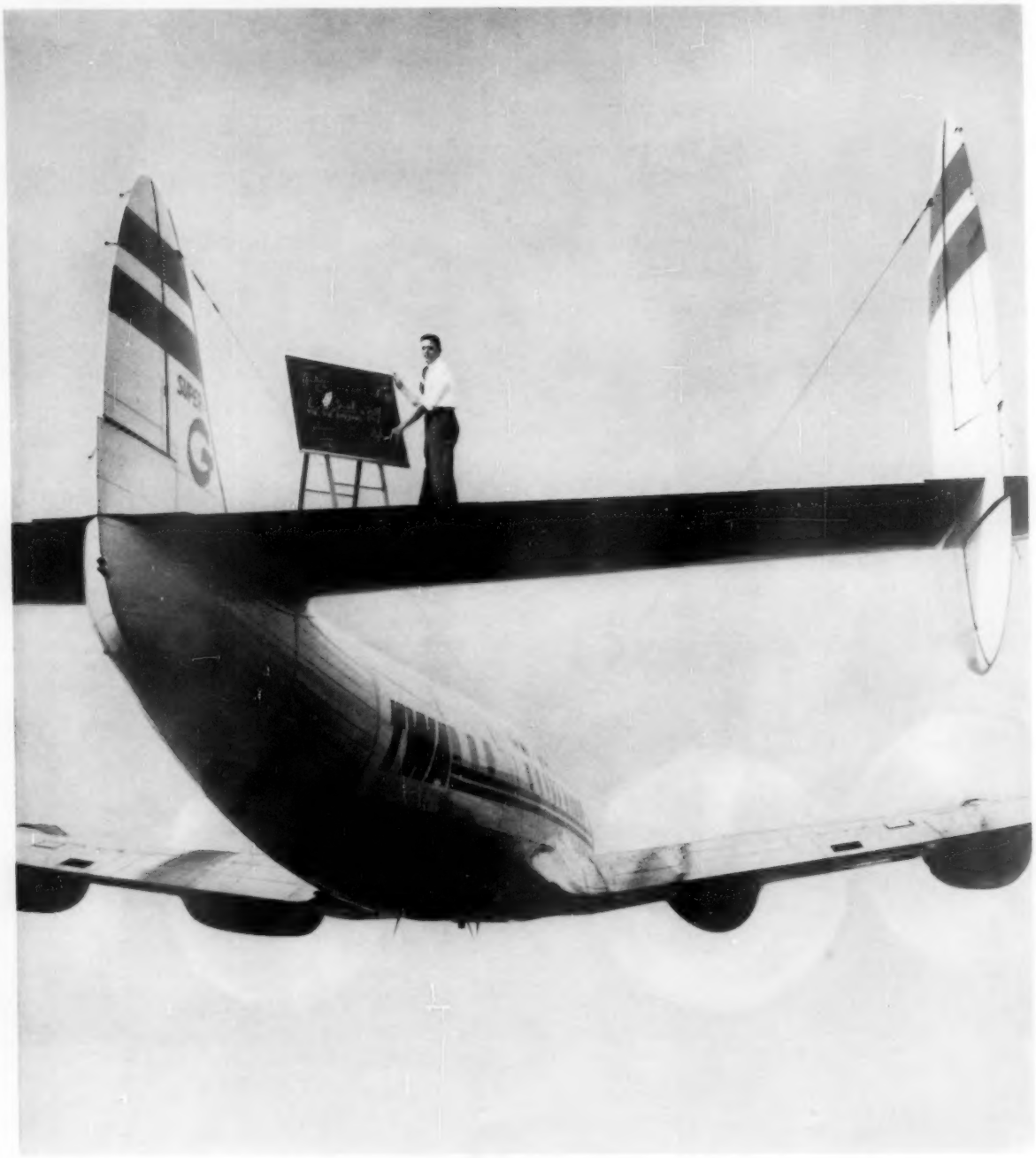
Nothing but the finest will bear the name of

MISSION MANUFACTURING CO.

Keep your valve costs down—specify Mission Mud Monarch!

MISSION MANUFACTURING CO. • P. O. Box 4209 • Houston, Texas • Cable Address—"Missco" • Export Office: 30 Rockefeller Plaza, New York
In The United Kingdom: MISSION MANUFACTURING CO., LTD. • 17 Hanover Square • London, W. I. England • Cable Address—"Missoman"

SLUSH PUMP VALVES • PISTONS • VALVE SEAT PULLERS • LINERS • PISTON RODS • VALVE SPRINGS • GLAND PACKINGS • SLIPS • SWABS • PLUG VALVES • CENTRIFUGAL PUMPS



Oilmen <u>should</u> be up in the air! An oil company physicist and his slate of equations may seem out of place in the sky. But airmen couldn't get off the ground without oilmen. Oil helped fly 50 million passengers on U. S. air lines last year. And oil company researchers are developing jet and rocket fuels that will shrink tomorrow's world even more. Remember these things when you hear misinformed people speak against your industry. Speak up—tell how you help give America wings! **SHELL OIL COMPANY**

nate all product sales and field sales activities for the company. Prior to this appointment, he was sales manager of the industrial sales division. Schlegel has had over 20 years' experience in the instrument field, handling the sale and application of industrial instruments and components to all major industries.

Hemion transfers from the New Jersey district sales office which he managed for many years. He has had over 30 years of instrument field sales experience with Weston.

Longhorn Incorporates, Appoints Officials

Incorporation of Longhorn Suppiy Co. and appointment of officials has been announced by G. W. (Mike) Hunt,

G. W. HUNT

H. P. FOGLE

C. T. SLAUGHTER

F. M. MORRIS

Longhorn president. Until February the firm was a partnership between Hunt and Claude R. Whelchel, Sr. The latter recently sold his interest.

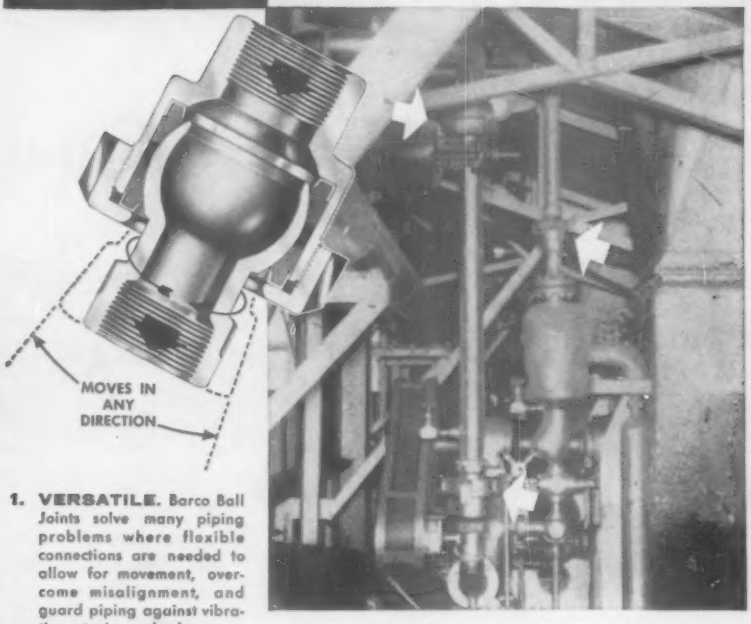
New Longhorn vice presidents are H. P. Fogle and Carl T. Slaughter, both of Houston, and E. E. Samford, Bridgeport, Tex. General manager and secretary-treasurer is F. M. Morris.

Fogle has been with Longhorn since 1951. Prior to that time, he was with Oil Well Supply Division as store manager, district manager and assistant division manager.

Slaughter has been with Longhorn 11 years. He was with Brown & Root Construction Co. 4½ years prior to that. A member of the Longhorn staff since 1947, Morris has been in Houston since 1943 and was with National Supply Co. 3 years.

Samford is manager of Longhorn's Bridgeport supply outlet in Wise County and has been with the company 10 years. He was in Houston on the city sales staff until a year ago.

BARCO *Flexible* BALL JOINTS



1. **VERSATILE.** Barco Ball Joints solve many piping problems where flexible connections are needed to allow for movement, overcome misalignment, and guard piping against vibration, strain or shock.
2. **MAXIMUM FLEXIBILITY.** Up to 40° side flexibility with 360° rotating movement.
3. **MANY STYLES AVAILABLE.** Angle or straight; threaded or flanged connections. For pressures to 4500 psi; temperatures to 1000°F. 15 different sizes, ¼" to 12".
4. **CHOICE OF MATERIALS.** Built to meet service requirements for steam, oil, gasoline, water, chemicals, and other fluids.
5. **ENGINEERING RECOMMENDATIONS.** Barco will be glad to send you complete information—ASK FOR BULLETIN No. 2158.

Solve STEAM Line Connection Problem

IN this Texas gasoline plant power house (above), Barco Ball Joints were used to replace steam hose which burst when used for connections from overhead header to draft fan turbines located on the tops of four boilers. These connections must handle 467°F. steam at 250 psi and allow movement to take up wear on the turbine-to-fan belt drive.

The problem was solved permanently by using steel pipe made *flexible* with Barco Ball Joints—two 1" joints on inlet line to each turbine and two 2½" joints in each exhaust line (see arrows). THESE JOINTS HAVE NOW BEEN IN SERVICE SEVERAL YEARS WITH NO ATTENTION AND NO FAILURES.

For recommendations and information, see your local Barco representative or write.

FOUNDED 1908 BARCO PRODUCTS BACKED BY EXPERIENCE

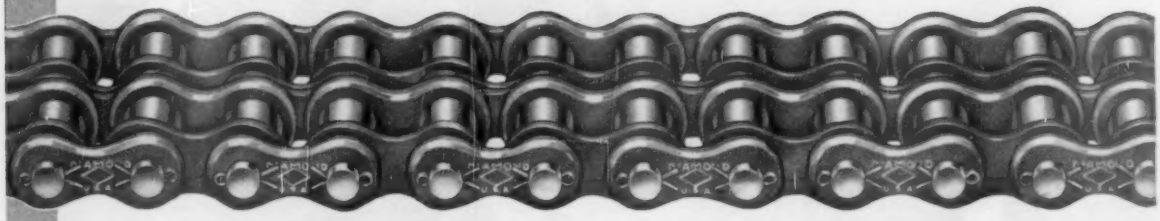
BARCO MANUFACTURING CO.
539D Hough Street • Barrington, Illinois

The Only Truly Complete Line of Flexible Ball, Swivel, Swing and Revolving Joints
In Canada: The Holden Co., Ltd., Montreal

Only one roller chain

bears this ➧ Trade ◇® Mark

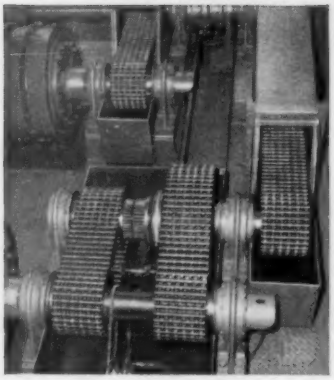
Trade Mark of Quality



Throughout over 65 years of engineering and manufacturing experience, the Diamond Chain Company has expended all effort in the continuous improvement of one type of product—Roller Chain.

From the raw material specifications through every step of manufacture, heat treatment, shot-peening, preloading, and multiple inspection, a long tradition of highest uniform quality has been indelibly established.

Only this product bears the Diamond ◇ Trade Mark.



DIAMOND CHAIN COMPANY, Inc.

Where High Quality is Traditional

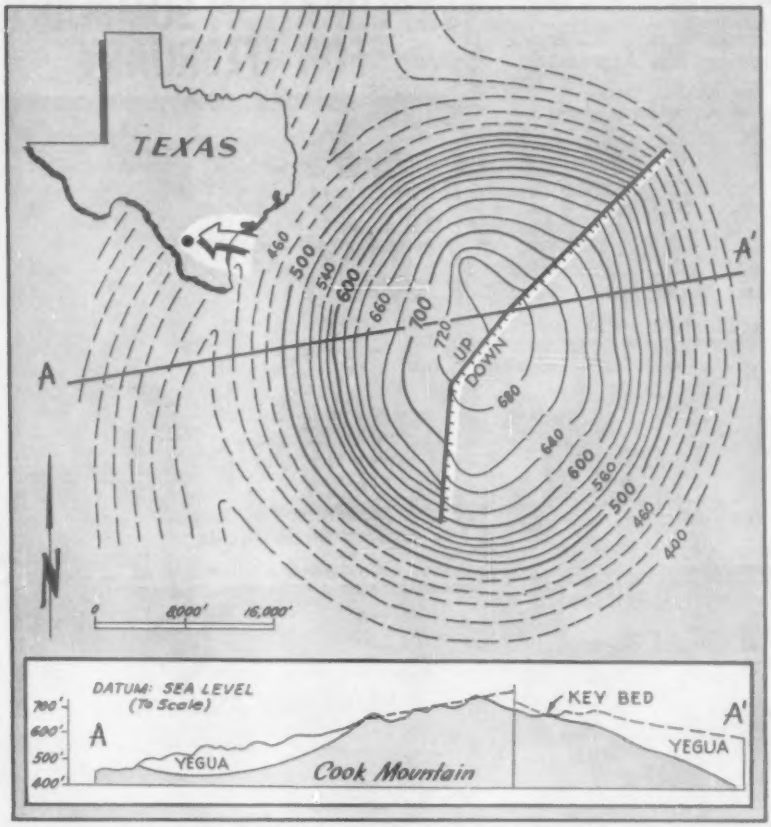
Dept. 475, 402 Kentucky Ave., Indianapolis 7, Indiana

Tulsa Office: 2238 Terwilleger Blvd.

Offices and Distributors in All Principal Cities

DIAMOND **ROLLER CHAINS**

DIAMOND ROLLER CHAINS



A 17,500-FT. WILDCAT now is probing the "condemned" Pescadito uplift in Webb County, Texas. This surface map and profile, and much of the data in this story, are from a report by Wilford L. Stapp, consultant, New Orleans; at the time of the report (1953), he was affiliated with Sunray Oil Corp.

A Perfect Structure. But . . .

Will It Yield Oil?

by Frank J. Gardner

IF at first you don't succeed . . . you can always drill another well. And that's exactly what one adventurous South Texas operator is up to. He's drilling a deep hole on one of the most frustrating, baffling, textbook structures in all of Texas. That's a picture of it up above. The contours are on the surface in this particular sketch, but on the top of the Wilcox, about 3,500 ft. deeper, the structure is just as perfect.

A temptation . . . But Pescadito dome has never yielded a commercial well. Lying 12 miles northeast of Laredo in Webb County, the pronounced surface uplift is about 10 miles in diameter, and has tempted South Texas wildcatters since the early twenties. The first "deep" test in early 1936 stopped in the Carrizo formation at 3,200 ft.; since then, nearly a score of other attempts have met with failure. One of these, Brewster & Bartle et al 1 Killam, went to 13,704 ft. in 1950; it revealed much new dope on the subsurface strata, but no oil. It is the only one to have penetrated the Cretaceous section; some geologists contend it stopped in the Edwards, while others hold that it did not reach that formation. The correlation feud arises from a dearth of fossil evidence below upper Taylor, and a continuous shale-limy shale section from 8,600 ft. on down.

The faulting shown on the surface map carries down through the section at least as far as the Wilcox top. Here, a series of faults, roughly parallel north-south, has developed, and a graben slices across the crest of the dome in approximately the same direction as the surface fault shown here. Other faults, at Wilcox level, cut across the western flank. Structural closure increases with depth from 280 ft. at the surface to about 1,000 ft. on the Wilcox.

Of major proportions . . . Many shows of oil and gas have been reported from Pescadito. These have come from the Tertiary beds, a succession of sands and shales hundreds of feet thick and of typical reservoir character. Every prerequisite for a major oil field is present at Pescadito . . . except the oil.

These Tertiary beds include 7,000 ft. of massive shales and sands.

The Brewster & Bartle deep test of 1950 was drilled on the crest of the uplift, west of the principal (surface) fault. Although there is difference of opinion on the section, the following Cretaceous sequence is offered as most reasonable: Midway shale 6,700 ft.; Navarro shale 7,600 ft., with sands at 8,000, 8,200, and 8,570 ft.; Taylor marl and shale 8,700 ft.; Austin shale 12,600 ft.; Eagle Ford, Buda, and Del Rio undifferentiated shale from 12,850 to 13,300 ft.; Georgetown shale and limy shale 12,300 ft. to total depth 13,704 ft.

May be multiplied . . . Now, Ginther, Warren & Ginther et al are well under way with the newest operation at Pescadito; they're aiming at 17,500 ft., an unusually deep hole for this South Texas country. Obviously, they expect to test the Edwards and possibly older rocks. The new wildcat lies less than a mile south of the Brewster & Bartle failure, but may be in the Wilcox graben. If so, an entirely new set of conditions may be uncovered as far as oil trapping is concerned. Now at the 6,000-ft. level, this ambitious try will be closely watched by Rio Grande observers.

It might well be the clincher in the long-standing condemnation of this "dry" structure. If it makes a well, either in the Tertiary or Cretaceous, it should tap a large reservoir. If it's dry, we may have to accept the theory, widely cited, that the oil that might have been trapped at Pescadito passed it by before the uplift occurred. A beautiful structure, yes, but if it were oil-wet, its attractions would be multiplied. **End.**

THE JOURNAL'S EXPLORATION SUMMARY FOR FEBRUARY
Iroquois River Followup Scores in Granite Wash
Virginia Hills Appears to be Major Strike
Sturgeon Lake Discovery Adds Fifth Oil Pay
Outlook Area Wildcat Tests Ordovician and Silurian
Remote North Dakota Apparent Discovery
Paradox Basin Success Still Grabs Lead
First Mississippian Sand Oil In Oklahoma Panhandle
Lipscomb County Bags Third Field
Rank Smackover Discovery Completed
Stonewall Well Is Cambrian Discovery
Two Galveston Wildcats Boost Coastward Potentialities
Deep Edwards Test Stirs Far Southwest Texas
Offshore Louisiana Discovery Pace Quickens . . . Five New Fields

February is busy month for extensive exploratory activity but . . .

Paradox and Offshore—Nation's Best

John C. McCaslin

A DISCOVERY surge off the coast of South Louisiana vied with the Paradox-basin success race for top exploratory interest in February. For the second straight year the shortest month looms as one of the year's outstanding discovery periods. Last year it was Red Earth—this year it is Louisiana Offshore and the Paradox basin.

Gulf waters busy . . . The Gulf of Mexico drilling spree is on in earnest. Deepwater exploration netted five new fields; three oil and two gas-distillate. Here is the month's tally sheet off South Louisiana.

. . . Off Lafourche Parish. Gulf Oil Corp. 1-D Louisiana State Lease 1423 is a new field in the South Timbalier Block 21 area. The well flowed 404 bbl. of oil per day on 7/64-in. choke from perforations at 10,615-33 ft., the deeper zone; flow from the shallower pay at 10,216-30 ft. was 380 bbl. of oil per day on 7/64-in. choke. This new field is 4 miles south of big Timbalier Bay field.

. . . Gulf A-1 OCS 0498 South Timbalier 128 is a new gas-condensate field. The high-gas-ratio well made 95 bbl. of condensate per day on 12/64-in. choke from perforations at 14,352-86 ft.

. . . Off St. Mary Parish. Phillips Petroleum Co. 2-B OCS 0471 (Dome B) is a prolific gas-condensate discovery in the Eugene Island Block 172 area. Calculated open flow was 80,000 M.c.f. of gas per day and 1,440 bbl. condensate from perforations at 14,369-89 ft.

. . . Off Terrebonne Parish. California Co. opened an oil field off Terrebonne Parish at its 1 Lousiana State 774 OCS 070 in the Ship Shoal Block 107 area. This discovery flowed 310 bbl. of oil per day on 10/64-in. choke from perforations at 9,414-25 ft.

. . . Off Vermilion Parish. Shell Oil Co.'s new oil-field discovery 45 miles offshore marks another major stepout in exploration along the outer fringes of Louisiana's Continental Shelf. Shell 1 Shell-Humble OCS 0493 in Vermilion Block 164 area, is the sixth field found within the 45-50 mile range from land, and the farthest offshore in the Vermilion area. Nearest production is California Co.'s Block 160 East Cameron area gas-condensate discovery, 16 miles west. Shell's well flowed 220 bbl. of oil and 99 M.c.f. of gas per day on 9/64-in. choke from perforations at 6,758-72 ft. The second well bore is underway.

Paradox explodes . . . The Paradox-

Total February Completions, Exploration and Development

	Total completions							Total wildcat wells							Act.
	Total	Oil	Gas	Dry	Footage	Ser.	C.	Total	Oil	Gas	Dry	Footage	C.T.	D.D.	op.
Alabama	7	6	0	1	80,017	0	0	1	0	0	1	11,025	2	0	27
Arkansas	57	40	1	16	153,953	0	0	10	1	0	9	32,904	3	0	78
California	156	108	5	43	687,096	1	1	42	6	1	35	209,265	0	9	222
Colorado	82	16	8	58	430,578	0	0	50	2	2	46	257,079	0	0	58
Florida	2	0	0	2	10,113	0	0	2	0	0	2	10,113	0	0	2
Illinois	182	85	1	96	398,576	0	0	36	5	0	31	80,021	49	0	398
Indiana	51	17	1	33	77,864	1	0	11	0	0	11	14,601	35	3	71
Kansas	333	172	29	132	1,217,296	7	0	47	14	2	31	193,019	61	0	383
Kentucky	90	31	14	45	149,376	0	0	19	0	0	19	22,787	80	1	189
West	73	30	1	42	100,494	0	0	18	0	0	18	19,825	63	1	124
East	17	1	13	3	48,882	0	0	1	0	0	1	2,962	17	0	65
Louisiana	288	147	48	93	2,383,272	0	0	50	7	8	35	500,487	0	2	457
North	93	56	8	29	388,876	0	0	16	1	1	14	97,112	0	0	114
South	136	55	28	53	1,434,803	0	0	25	3	5	17	293,825	0	2	231
Offshore	59	36	12	11	559,593	0	0	9	3	2	4	109,550	0	0	112
Michigan	29	16	0	13	95,511	0	0	11	2	0	9	30,382	15	0	99
Mississippi	30	14	0	16	221,254	0	0	15	2	0	13	117,576	0	0	28
Montana	14	8	0	6	96,635	0	0	4	1	0	3	33,136	3	0	51
Nebraska, West	60	19	0	41	350,763	0	0	29	3	0	26	158,927	0	0	48
Nevada	1	0	0	1	8,508	0	0	1	0	0	1	8,508	0	0	3
New Mexico	130	72	29	29	608,103	0	1	27	6	2	19	167,263	3	2	190
Northwest	41	6	28	7	138,352	0	1	9	2	2	5	42,755	0	0	76
Southeast	89	66	1	22	469,751	0	0	18	4	0	14	124,508	3	2	114
North Dakota	32	16	0	16	211,580	0	0	15	2	0	13	79,912	0	0	27
Ohio	79	45	15	19	184,339	6	0	1	0	0	1	3,690	0	0	98
Oklahoma	493	315	10	168	1,618,947	26	5	50	11	1	38	228,862	85	15	814
Oregon	1	0	0	1	4,506	0	0	1	0	0	1	4,506	0	0	1
Pennsylvania	12	0	9	3	80,977	0	0	7	0	4	3	53,992	6	0	37
South Dakota	2	0	0	2	8,170	0	0	2	0	0	2	8,170	0	0	4
Texas	1,765	1,075	90	600	7,432,458	10	4	460	50	20	390	2,033,636	92	8	1,264
Dist. 1	94	56	1	37	256,075	0	0	32	4	0	28	108,363	2	0	63
Dist. 2	62	16	16	30	388,323	0	0	25	1	5	19	158,081	0	0	51
Dist. 3	152	68	20	64	1,056,918	1	0	53	4	6	43	422,338	0	0	128
Dist. 4	121	50	16	55	591,208	1	0	42	6	3	33	208,412	0	0	86
East	107	51	13	43	574,912	0	1	28	1	1	26	155,805	0	2	106
Dist. 7-B	227	118	0	109	666,389	0	0	83	5	0	78	242,247	34	3	134
West	458	397	4	57	2,332,491	0	0	53	13	3	37	310,554	43	1	459
Dist. 9	422	224	3	195	1,089,570	8	0	138	15	1	122	385,100	13	2	131
Dist. 10	122	95	17	10	476,572	0	3	6	1	1	4	42,736	0	0	106
Utah	9	5	1	3	55,207	0	0	3	0	0	3	19,312	0	3	53
West Virginia	55	8	38	9	159,333	0	0	3	0	1	2	15,973	50	0	191
Wyoming	47	18	2	27	186,324	0	0	20	1	2	17	82,420	8	2	149
Total Feb. 1957	4,007	2,233	301	1,473	16,910,756	†51	†11	917	*113	43	761	4,377,566	492	45	4,942
Total Jan. 1957	5,158	2,667	361	2,130	21,493,184	61	46	1,336	168	50	1,118	6,527,629	716	38	4,900
Cumulative 1957	9,165	4,900	662	3,603	38,403,940	112	57	2,253	281	93	1,879	10,905,195	1,208	83	....
Cumulative 1956	9,570	5,176	626	3,768	39,466,330	....	....	2,178	307	66	1,805	10,495,420	....	....	....
Western Canada	230	144	16	70	1,043,707	1	....	72	5	9	58	318,327	....	....	....
Alberta	111	66	11	34	568,608	1	....	39	2	8	29	194,803	....	....	....
Saskatchewan	85	61	0	24	373,075	....	....	21	2	0	19	84,111	....	....	....
Manitoba	23	16	0	7	53,299	....	....	7	0	0	7	19,783	....	....	....
British Columbia	11	1	5	5	48,725	....	....	5	1	1	3	19,630	....	....	....
Canada cum. 1957	454	306	27	121	2,059,742	1	....	119	8	12	99	525,428	....	....	....
Alberta cum.	227	147	19	61	1,168,883	1	....	64	2	10	52	321,858	....	....	....
Saskatchewan cum.	161	124	0	37	704,960	....	....	36	5	0	31	139,254	....	....	....
Manitoba cum.	51	34	0	17	114,452	....	....	12	0	0	12	32,811	....	....	....
B. C. cum.	15	1	8	6	71,447	....	....	7	1	2	4	31,505	....	....	....

*Incl. 3 cond. disc.: New Mexico 1, Oklahoma 1, Texas Panhandle 1. †Service wells included in dry, condensate wells in oil.
Note: Ser. (service wells); C. (cond. wells); C.T. (cable-tool compl.); D.D. (O.W.D.D.); Act. op. (active operations).

basin story for February is one of prolific oil flows, new fields, new extensions, and rapid development. Exploratory excitement in this newest of oil coffers is at a feverish pitch. The month's events include:

... **Best gage yet.** San Juan County, Utah's Aneth area tapped its best-flowing Pennsylvanian well yet. The Texas Co. completed the 6 Navajo-C for a daily gage of 3,462 bbl. from two zones. Location of this first multiple-zone completion in the basin is ¾ mile south of Aneth field proper.

... **Prolific North Desert Creek extension.** Shell Oil Co. 22-12 North Desert Creek, northwest extension well in this Paradox basin field, flowed oil at the daily rate of 1,400 bbl. from perforations in the Paradox-Pennsylvanian at 5,409-98 ft. The well also indicated good production from the upper Hermosa zone. Location is ½ mile northwest of the field. North Desert Creek has four producers.

... **New fields.** Two new field prospects in 2 days at the end of the month boosted the basin's success stock to new heights.

... **Davis Oil Co.** had a flow of 45 bbl. per hour on drill-tem test of the Paradox at 5,510-90 ft. at its first try in the basin, the 1 Navajo-A, 4 miles from production. Location of this important find is 4½ miles southeast of North Desert Creek field, and about the same distance northeast of Desert Creek field. The discovery, which will be called East Desert Creek, forms a triangle with the other Desert Creek fields.

Close on the heels of Davis' new strike, **Pan American Petroleum Corp. 1 Featherstone** flowed oil at the rate of 6 bbl. per hour on drill-stem test of the upper Hermosa at 5,402-54 ft. This new field prospect is west of Recapture Creek field, 5 miles northeast of Bluff

Breakdown in Footage for February 1957

	Field footage			Wildcat footage		
	Oil	Gas	Dry	Oil	Gas	Dry
Alabama	68,992	0	0	0	0	11,025
Arkansas	97,883	5,514	17,652	3,990	0	28,914
California	416,883	21,923	39,025	16,575	6,963	185,727
Colorado	84,446	35,611	53,442	10,281	10,715	236,083
Florida	0	0	0	0	0	10,113
Illinois	176,807	278	141,470	13,258	0	66,763
Indiana	25,031	881	37,351	0	0	14,601
Kansas	558,576	114,998	350,703	54,465	11,479	127,075
Kentucky	47,114	36,639	42,836	0	0	22,787
West	43,114	1,795	35,760	0	0	19,825
East	4,000	34,844	7,076	0	0	2,962
Louisiana	937,441	432,394	512,950	66,027	99,188	335,272
North	170,274	53,741	67,749	1,427	9,921	85,764
South	496,370	265,581	379,027	33,105	61,529	199,191
Offshore	270,797	113,072	66,174	31,495	27,738	50,317
Michigan	52,347	0	12,782	4,607	0	25,775
Mississippi	84,079	0	19,599	25,336	0	92,240
Montana	40,553	0	22,946	6,309	0	26,827
Nebraska, W.	100,438	0	91,398	18,417	0	140,510
Nevada	0	0	0	0	0	8,508
New Mexico	321,354	80,414	39,072	42,762	13,520	110,981
Northwest	14,387	77,014	4,196	8,095	13,520	21,140
Southeast	306,967	3,400	34,876	34,667	0	89,841
North Dakota	115,709	0	15,959	12,940	0	66,972
Ohio	106,702	33,293	40,654	0	0	3,690
Oklahoma	971,535	48,299	370,251	63,799	3,105	161,958
Oregon	0	0	0	0	0	4,506
Pennsylvania	0	26,985	0	0	30,203	23,789
South Dakota	0	0	0	0	0	8,170
Texas	4,158,687	407,289	832,846	297,131	137,444	1,599,061
Dist. 1	119,033	6,360	22,319	16,954	0	91,409
Dist. 2	101,602	63,392	65,248	5,738	33,839	118,504
Dist. 3	368,340	114,866	151,374	36,510	45,328	340,500
Dist. 4	179,420	68,675	134,701	35,012	18,966	154,434
East	238,841	82,350	97,916	7,231	9,244	139,330
Dist. 7-B	342,243	0	81,899	23,679	0	218,568
West	1,910,967	6,487	104,483	96,664	19,367	194,523
Dist. 9	549,119	11,581	143,770	64,816	3,500	316,784
Dist. 10	349,122	53,578	31,136	10,527	7,200	25,009
Utah	29,422	6,473	0	0	0	19,312
West Virginia	14,665	110,150	18,545	0	4,626	11,347
Wyoming	77,807	0	26,097	1,385	10,364	70,671
Total U. S.	8,486,471	1,361,141	2,685,578	637,282	327,607	3,412,677
Western Canada	633,063	32,699	59,618	28,170	42,197	247,960
Alberta	333,359	11,369	29,077	14,357	38,397	142,049
Saskatchewan	266,188	0	22,776	9,260	0	74,851
Manitoba	33,516	0	0	0	0	19,783
British Columbia	0	21,330	7,765	4,553	3,800	11,277

townsite, and 2 miles north of West Desert Creek field. It moves Aneth trend production to its westernmost point.

The Regional Rundown

Despite the resounding successes off Louisiana's shores and in the Paradox basin, the wildcat drill uncovered important discoveries in Texas, Oklahoma, western Canada, and the Williston basin.

In Texas . . . Two wildcats in Galveston County stirred Gulf Coast excitement, boosting coastward potentialities in the prolific Chocolate Bayou field area.

Hassie Hunt Trust **1 Sayko,** 5 miles east of Chocolate Bayou, flowed at daily rates of 604 bbl. oil from a portion of 30 ft. of Frio sand at 11,285 ft., and 2,600 M.c.f. of gas with 110 bbl. of distillate from part of a 15-ft. sand at 11,488 ft. Phillips Petroleum Co. has about 50 per cent interest in the well.

The other discovery, **1 Sass,** 2¼ miles southeast of 1 Sayko, tested considerable gas and gas distillate from the bottom section of 56 ft. of sand at 11,149 ft. Phillips owns 58 per cent interest in this well.

. . . Ginther, Warren & Ginther started a deep Edwards wildcat on the Pescadito structure in south-central Webb County, stimulating speculation of the possibility of another major extension of deep Edwards play southwestward from LaSalle and McMullen counties in Southwest Texts.

. . . The Texas Co. and Wheelock Oil Co. 1 Edens, Navarro County, East Texas, is a new Smackover gas-distillate field, 30 miles north of comparable production.

. . . J. R. McLean and J. D. Tomplins 1-A Trammell, Stonewall County's Cambrian prospect in Tompkins field, was completed in the Ellenburger, but operators expect to dually complete in the Cambrian, which would move production from this zone 35 miles north of existing Cambrian fields.

. . . Humble Oil & Refining Co. opened Lipscomb County's third producing area in the Texas Panhandle's northeastern corner. The 1 Cowan is a Morrow-Pennsylvanian gas-distillate strike.

In Oklahoma . . . The first Mississippian sand production in Beaver County, Oklahoma Panhandle, was opened by Phillips at Blakemore. The discovery flowed 824 bbl. per day. Previous Mississippian production in this region is from lime.

In Williston . . . The prospects of a new producing county in North Dakota and indicated success at the Outlook area wildcat in Sheridan County, Montana, held the Williston spotlight.

. . . At month's end **W. A. Hanlon and Lowell J. Williamson** swabbed 10 bbl. oil per hour at 1 Knudtson wildcat in Ward County. Production is from Mission Canyon open hole. Success at this test would open first production in the county. Location is 40 miles east of Nesson anticline fields.

. . . Amerada Petroleum Corp. 1 Loucks, the closely watched second well in the Outlook area of northeastern Montana, recovered oil on tests of both the Red River-Ordovician and the Silurian. A third well is drilling in this important Williston basin sector. The field discovery well, 1 Tange, flowed 2,742 bbl. of Silurian oil daily on completion.

In Canada . . . Granite Wash confirmation at Iroquois River, a new pay in the Sturgeon Lake area, and prospects for a major oil discovery at Virginia Hills were the Alberta newsmakers in February.

. . . Iroquois River. Triad Oil Co.'s followup well at Iroquois River in northwestern Alberta was successful in the Granite Wash pay. This is the second offset well in Canada in recent months to confirm a Granite Wash producing area—the other was at Red Earth.

. . . New pay. Amerada's new discovery in the Sturgeon Lake area coupled with a Hudson's Bay strike raised the number of prospective oil zones here to five, which include besides the two new sectors, the Triassic, Rundle, and D3 formations. Amerada's new find is the D2; Hudson's Bay's hit was in the Winterburn.

. . . Virginia Hills. Home Oil Co., Ltd., tapped a 65-ft.-thick lower Beaverhill Lake or Slave Point pay section at this apparently major Alberta oil discovery. Location of this test is 125 miles northwest of Edmonton. Testing continued at month's end.

"...used by more drillers on more mud pumps than any other V-belt made"

4 engineering features make Rib-Top world leader

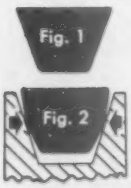
You save money... save time... when you order Gates V-Belts — developed *specifically for mud pump drives.*

In oil fields around the world, drillers reduce the work delays and costs due to belt replacement, by using Gates Rib-Top with these four important features:—

1. Tougher, More Resilient Tensile Cords.

Enable Rib-Top V-Belts to absorb severe pulsations of the mud pump—easily handle peak loads.

2. Concave Sidewalls (U.S. Pat. No. 1813698).

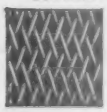


Provide sure pulling power, less wear, longer V-belt life, because as belt bends around a sheave, concave sides fill out...become straight ...fit sheave grooves evenly (Fig. 1). Straight-sided belts bulge at the sides when bent. Uneven contact (Fig. 2) causes uneven wear, shorter belt life.

3. Stabilizing Ribbed Top (U.S. Pat. No. 2548135)

Dampens vibration . . . protects top of belt against damage . . . keeps belt running smoothly over idler-equipped mud pump drives, with no side whip.

4. Flex-Weave Cover (U.S. Pat. No. 2519590).



Insures greater flexibility with far less stress on fabric. Wears longer . . . increases belt life . . . lowers belt costs . . . makes more power available to driven machine.

You pay no more for Rib-Tops than for ordinary belts of comparable ratings. Both Standard and Super Rib-Top V-belts are available from your oil supply house. Specify Gates Rib-Top next time you order. The Gates Rubber Co., Denver, Colorado—*World's Largest Maker of V-Belts.*

For Toughest Drives Use *Super* Rib-Top

40% greater horsepower capacity. Handles drive overloads and shock loads easily. Increased capacity solves weight and space problems by permitting narrower sheaves and fewer belts.

Gates®

The Mark of Specialized Research

TPA 92

Gates Rib-Top Vulco Rope

DEVELOPED ESPECIALLY FOR MUD PUMP DRIVES

Stop thief formations!

JELFLAKE makes mud money go farther

Many operators make a routine practice of adding Jelflake® to their drilling mud. A few sacks of this inexpensive lost-circulation material help avoid mud loss *before* it occurs. Many porous formations and fractures that might steal costly drilling fluid are readily sealed off with the use of Jelflake.

Jelflake, the fragmented plastic foil developed by Dowell, is made up of crinkled particles of various sizes. This allows the smaller bits to plug formation pores, while the larger fragments flatten out on the surface wall to provide a fast, effective seal.

Jelflake is available in strong, wetproof bags at major mud distributors and local Dowell stations. For more information, call any of the 165 Dowell offices in the United States and Canada; in Venezuela, contact United Oilwell Service. Or write Dowell Incorporated, Tulsa 1, Oklahoma.

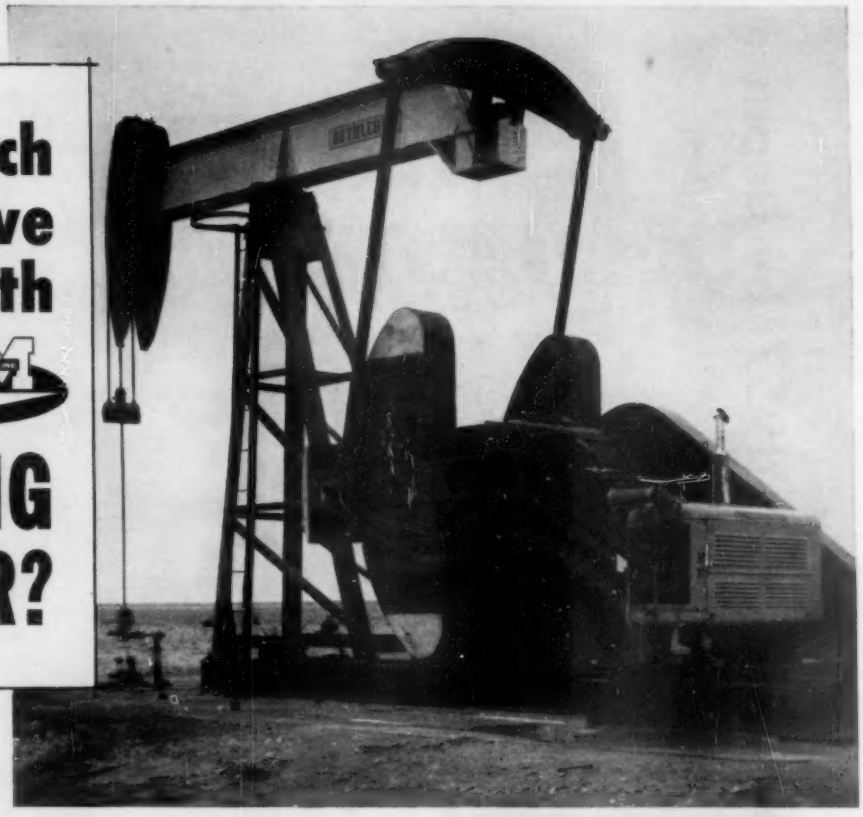
Services for the oil industry

DOWELL

Breakdown of Field Wells Drilled in February 1957, by Depth

	0-1,250 A			1,250-2,500 B			2,500-3,750 C			3,750-5,000 D			5,000-7,500 E			7,500-10,000 F			10,000-12,500 G			12,500-15,000 H			15,000 and over I		
	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry
Alabama	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0
Arkansas	0	0	1	26	0	3	11	0	2	2	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
California	19	0	0	25	0	2	18	1	2	12	0	0	11	3	3	8	0	1	6	0	0	3	0	0	0	0	0
Colorado	0	0	1	0	0	2	1	0	0	3	1	3	7	4	5	3	1	1	0	0	0	0	0	0	0	0	0
Illinois	12	1	11	29	0	24	39	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Indiana	9	1	8	7	0	11	1	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kansas	0	0	0	18	0	14	88	7	54	41	17	27	11	3	6	0	0	0	0	0	0	0	0	0	0	0	0
Kentucky	12	0	10	16	5	11	2	5	4	1	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
West	12	0	10	16	1	11	2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
East	0	0	0	0	4	0	0	5	1	1	4	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Louisiana	1	0	1	30	0	2	16	2	6	10	0	3	23	1	15	30	14	6	20	11	16	6	9	6	4	3	3
North	1	0	0	30	0	2	11	1	5	7	0	2	3	1	6	2	4	0	1	1	0	0	0	0	0	0	0
South	0	0	0	0	0	0	5	1	1	2	0	1	11	0	8	8	5	5	16	9	14	6	5	5	4	3	2
Offshore	0	0	1	0	0	0	0	0	0	1	0	0	9	0	1	20	5	1	3	1	2	0	4	1	0	0	1
Michigan	1	0	0	0	0	1	5	0	2	7	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Mississippi	0	0	0	0	0	0	0	0	0	2	0	1	7	0	1	1	0	0	2	0	1	0	0	0	0	0	0
Montana	0	0	0	0	0	0	4	0	0	0	0	1	0	0	0	3	0	2	0	0	0	0	0	0	0	0	0
Nebraska, West	0	0	0	0	0	0	0	0	0	0	0	2	16	0	13	0	0	0	0	0	0	0	0	0	0	0	0
New Mexico	2	0	2	8	7	2	8	19	3	33	0	1	5	1	0	0	0	2	9	0	0	1	0	0	0	0	0
Northwest	0	0	1	2	7	0	0	18	1	1	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Southeast	2	0	1	6	0	2	8	1	2	32	0	1	4	0	0	0	0	2	9	0	0	1	0	0	0	0	0
North Dakota	0	0	0	0	0	0	2	0	1	0	0	1	0	0	0	11	0	1	1	0	0	0	0	0	0	0	0
Ohio	14	4	5	0	3	3	29	8	7	2	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oklahoma	31	0	20	93	2	37	93	0	43	44	2	19	26	5	6	16	0	5	0	0	0	1	0	0	0	0	0
Pennsylvania	0	0	0	0	0	0	0	2	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0
Texas	80	0	26	238	9	65	256	14	25	164	5	26	180	20	41	72	17	21	28	5	5	7	0	1	0	0	0
Dist. 1	19	0	3	16	0	2	7	0	2	6	0	0	4	1	2	0	0	0	0	0	0	0	0	0	0	0	0
Dist. 2	0	0	0	0	0	0	2	3	0	1	2	5	6	2	4	6	4	2	0	0	0	0	0	0	0	0	0
Dist. 3	4	0	1	5	0	1	5	2	1	15	0	2	14	1	4	17	6	8	4	0	4	0	0	0	0	0	0
Dist. 4	1	0	0	9	3	0	13	2	3	8	2	6	11	2	8	1	4	4	1	0	1	0	0	0	0	0	0
East	0	0	1	6	0	0	11	0	1	8	1	0	23	8	14	2	3	1	0	0	0	0	0	0	0	0	0
Dist. 7-B	17	0	5	45	0	14	15	0	6	18	0	3	18	0	3	0	0	0	0	0	0	0	0	0	0	0	0
West	7	0	1	40	0	1	121	0	6	77	0	3	73	1	3	36	0	5	23	0	0	7	0	1	0	0	0
Dist. 9	32	0	15	104	0	46	15	0	4	31	0	7	26	2	1	1	0	0	0	0	0	0	0	0	0	0	0
Dist. 10	0	0	0	13	6	1	67	7	2	0	0	0	5	3	2	9	0	1	0	0	0	0	0	0	0	0	0
Utah	0	0	0	0	0	0	0	0	0	0	0	0	5	1	0	0	0	0	0	0	0	0	0	0	0	0	0
West Virginia	1	1	1	7	14	2	0	11	2	0	11	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wyoming	0	0	5	3	0	1	4	0	1	4	0	1	5	0	1	1	0	1	0	0	0	0	0	0	0	0	0
Total U. S.	182	7	91	500	40	180	577	69	185	325	40	92	297	42	92	145	32	40	72	16	22	18	9	7	4	3	3
Western Canada	0	0	0	20	1	0	5	0	1	77	4	7	30	2	3	7	0	1	0	0	0	0	0	0	0	0	0
Alberta	0	0	0	4	1	0	2	0	1	22	2	1	29	0	2	7	0	1	0	0	0	0	0	0	0	0	0
Saskatchewan	0	0	0	0	0	0	3	0	0	55	0	4	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Manitoba	0	0	0	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
British Columbia	0	0	0	0	0	0	0	0	0	0	2	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0

how much do you save per month with MM PUMPING POWER?



MM GAS-FUELED ENGINES

NET YOU $82 A MONTH ON EVERY 15-HP LOAD
...$197 A MONTH ON EVERY 35-HP LOAD
...$410 A MONTH ON EVERY 70-HP LOAD

MM high-turbulence combustion chambers provide complete fuel mixing, progressive burning, controlled pressure rise, greater torque at lower rpm
MM removable cylinder blocks offer lowest-cost maintenance, long skirt design for improved cooling. Extra crankcase depth below crankshaft centerline and heavy base-pan flange prevent distortion —reduce wear.
MM thermo-clad base-pans are completely water-jacketed for top-to-bottom temperature control and improved oil filtering.
ONLY MM ENGINES GIVE YOU THESE DOLLAR-SAVING ADVANTAGES!

Dollar savings over electric motor costs on wells pumped with gas-fueled Minneapolis-Moline engines go up with the horsepower size. The low cost of natural gas fuel as against electric power rates plus the big maintenance savings made possible by MM long-run design net you bigger returns with every barrel of crude you pump. These savings alone can retire the cost of the entire installation in a matter of months.

Gas-fueled MM engines offer flexible operation for variable requirements without costly drive pulley changes that go with constant-speed electric motors.

These added production profits belong on *your* books. Contact your MM oil field distributor for the facts on MM gas-fueled engines. Ask about the important maintenance convenience offered by SECO flat-rate service.

INDUSTRIAL POWER DIVISION

MINNEAPOLIS-MOLINE MINNEAPOLIS 1, MINNESOTA

THE GOLDEN POWER LINE

DISTRIBUTED BY

SECO

SHRIMPTON MANUFACTURING & SUPPLY CO.

LOS ANGELES
Tel. RAymond 3-6549

BAKERSFIELD
Tel. FAirview 4-9716

OKLAHOMA CITY
Tel. JAckson 5-0225

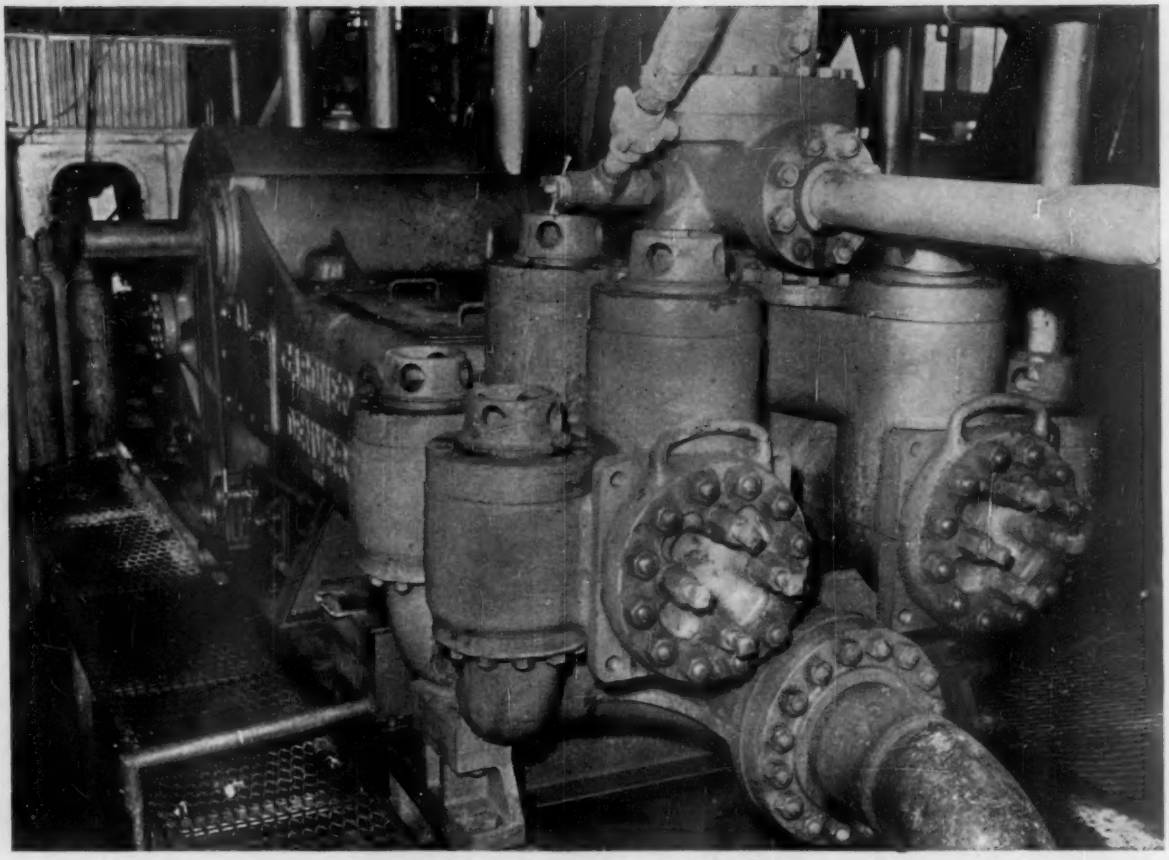
ODESSA
Tel. FEderal 7-4088

KILGORE
Tel. 4311

GLENDIVE
Tel. EMpire 5-2300

Breakdown of Wildcats Drilled in February 1957, by Depth

	0-1,250 A			1,250-2,500 B			2,500-3,750 C			3,750-5,000 D			5,000-7,500 E			7,500-10,000 F			10,000-12,500 G			12,500-15,000 H			15,000 and over I		
	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry	Oil	Gas	Dry
Alabama	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Arkansas	0	0	0	0	0	4	0	0	3	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
California	0	0	3	1	0	8	0	0	7	1	0	4	2	1	5	2	0	5	0	0	2	0	0	1	0	0	0
Colorado	0	0	0	0	0	1	0	0	5	0	1	15	2	1	22	0	0	3	0	0	0	0	0	0	0	0	0
Florida	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Illinois	1	0	9	1	0	10	2	0	11	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Indiana	0	0	7	0	0	3	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Kansas	0	0	1	1	0	1	4	0	7	8	0	16	1	2	6	0	0	0	0	0	0	0	0	0	0	0	0
Kentucky	0	0	13	0	0	4	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
West	0	0	13	0	0	4	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
East	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Louisiana	0	0	0	1	0	0	0	0	3	0	0	1	0	0	6	1	2	8	5	2	9	0	4	5	0	0	3
North	0	0	0	1	0	0	0	0	3	0	0	1	0	0	6	0	1	3	0	0	1	0	0	0	0	0	0
South	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	5	3	2	6	0	2	3	0	0	3
Offshore	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	2	0	2	0	2	2	0	0	0
Michigan	0	0	0	1	0	3	1	0	5	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mississippi	0	0	0	0	0	0	0	0	2	0	0	0	0	0	8	0	0	0	0	0	2	2	0	1	0	0	0
Montana	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	1	0	0	0	0	0	0
Nebraska, West	0	0	0	0	0	0	0	0	3	0	0	5	3	0	18	0	0	0	0	0	0	0	0	0	0	0	0
Nevada	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
New Mexico	0	0	3	0	0	2	2	0	2	1	0	5	1	2	1	0	0	0	0	0	4	2	0	2	0	0	0
Northwest	0	0	0	0	0	1	1	0	1	0	0	2	1	2	1	0	0	0	0	0	0	0	0	0	0	0	0
Southeast	0	0	3	0	0	1	1	0	1	1	0	3	0	0	0	0	0	0	0	0	4	2	0	2	0	0	0
North Dakota	0	0	0	0	0	0	1	0	5	0	0	3	0	0	2	1	0	3	0	0	0	0	0	0	0	0	0
Ohio	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oklahoma	0	0	6	1	0	6	3	1	7	1	0	4	2	0	8	3	0	6	1	0	1	0	0	0	0	0	0
Oregon	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pennsylvania	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	4	2	0	0	0	0	0	0	0	0	0
South Dakota	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Texas	0	1	29	6	0	135	6	2	55	9	2	50	14	6	64	10	7	38	5	2	16	0	0	3	0	0	0
Dist. 1	0	0	4	1	0	7	2	0	7	0	0	4	0	0	4	1	0	2	0	0	0	0	0	0	0	0	0
Dist. 2	0	0	1	0	0	0	0	1	0	0	0	4	1	2	9	0	1	4	0	1	1	0	0	0	0	0	0
Dist. 3	0	1	1	0	0	2	0	0	1	0	0	2	0	1	7	3	3	22	1	1	7	0	0	1	0	0	0
Dist. 4	0	0	3	0	0	1	1	0	9	1	1	6	3	1	11	1	1	0	0	0	3	0	0	0	0	0	0
East	0	0	0	0	0	2	0	0	3	0	0	11	1	0	5	0	1	3	0	0	2	0	0	0	0	0	0
Dist. 7-B	0	0	3	1	0	43	0	0	15	2	0	9	2	0	8	0	0	0	0	0	0	0	0	0	0	0	0
West	0	0	6	1	0	4	1	0	7	2	1	5	2	1	4	4	1	6	3	0	3	0	0	2	0	0	0
Dist. 9	0	0	11	3	0	76	2	1	12	4	0	9	5	0	14	1	0	0	0	0	0	0	0	0	0	0	0
Dist. 10	0	0	0	0	0	0	0	0	1	0	0	0	0	1	2	0	0	1	1	0	0	0	0	0	0	0	0
Utah	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
West Virginia	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Wyoming	0	0	0	1	0	5	0	1	3	0	0	3	0	0	5	0	1	1	0	0	0	0	0	0	0	0	0
Total U. S.	1	1	71	13	0	183	19	4	122	22	4	112	26	12	153	17	14	69	11	4	36	4	4	12	0	0	3
Western Canada	0	0	1	0	2	6	0	3	17	4	2	17	0	0	15	1	1	1	0	1	1	0	0	0	0	0	0
Alberta	0	0	1	0	2	1	0	3	7	1	1	8	0	0	10	1	1	1	0	1	1	0	0	0	0	0	0
Saskatchewan	0	0	0	0	0	4	0	0	3	2	0	7	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0
Manitoba	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
British Columbia	0	0	0	0	0	1	0	0	0	1	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0



Gardner-Denver Model GXN Power Pump

GARDNER-DENVER MUD PUMPS . . . designed for top efficiency—low maintenance

Gardner-Denver Mud Pumps will handle the maximum pressures encountered in today's drilling. Divided fluid end permits replacement of individual parts—on drilling location. Never necessary to replace complete mud end.

Gardner-Denver Service Specialists are strategically located throughout the oil country.

ENGINEERING FORESIGHT PROVED ON THE JOB
IN GENERAL INDUSTRY, CONSTRUCTION, PETROLEUM AND MINING

GARDNER - DENVER

Gardner-Denver Company, Quincy, Illinois
Export Division 233 Broadway, New York 7, New York
In Canada: Gardner-Denver Company (Canada), Ltd., 14 Curity Avenue, Toronto 16, Ontario

Continental Emsco Company
(A Division of the Youngstown Sheet and Tube Company)
Continental Building
Dallas, Texas

Continental Emsco Export Division
45 Rockefeller Plaza
New York 20, N. Y.

Republic Supply Company, P. O. Box 2137 Terminal Annex, Los Angeles 54, Calif.

APPALACHIAN

OHIO

Smith Petroleum 1 Lizzie Miller, Section 15, Franklin Township, Wayne County, an east offset to its discovery on 1 Baker, logged the Clinton at 3,455-3,521 ft. with a good showing natural. When gaged after fracture with 240 lb. held on tubing, the open flow was 625,000 cu. ft. and 150 bbl. in 24 hours.

• East of Union Furnace field in Starr Township, Hocking County, J. F. Bolin et al 2 F. H. Stines, Section 5, gaged 100 bbl. in 24 hours after fracture.

• Another gasser was completed in the expanding Knox Township, Holmes County pool. Wiser Oil 2 Phillip Reiheld, Section 15, gaged 1,750,000 cu. ft. after fracture from Clinton at 3,138-51 ft.

PENNSYLVANIA

In Armstrong Township, Indiana County, Southwest Pennsylvania, T. W. Phillips Gas & Oil Co. 4 G. W. Uncather, wildcat, elevation 1,213 ft., gaged 1,619,000 ft. gas after fracture. Onondaga 7,348 ft., chert 7,363 ft., Oriskany sand 7,565-7,585 ft. total depth 7,600 ft.

• New York State Natural Gas Corp. N-525 William George, elevation 1,268 ft., was a failure, Tully 6,910 ft., Onondaga 7,731 ft., salt water 7,851 ft., total depth 7,867 ft.

WEST VIRGINIA

In Beverly district, Randolph County, West Virginia, J. B. Ward has started operations in 1 fee, wildcat, elevation 1,992 ft., Elkins Quadrangle, 5.1 miles south of latitude 38 degrees 55 minutes and 2 miles west of longitude 19 degrees 50 minutes.

CALIFORNIA

Fillmore Find Touches Off New Flurry

Richfield Oil Corp.'s recent successful extension test in Fillmore field about ½-mile west of the town of Fillmore has touched off a flurry of activity in the deep Ventura County field. The Texas Co. has filed for a special use permit to drill on 198 acres on the northwest city limits. Union Oil Co. has filed for a similar permit on 116 acres 2 miles south of town. Meanwhile, Standard Oil Co. of California was drilling below 14,200 ft. on 10 Sespe Ranch in NE SW 26-4n-20w. Humble Oil & Refining Co. was drilling two other tests in NE 26-4n-20w. One was at 14,050 ft. and the other at 13,775 ft.

Water Troubles Plague New Tejon Discovery

Reserve Oil & Gas Co. has plugged off two lower intervals in its recent Vedder zone discovery 3 miles north of Tejon field in an effort to eliminate excessive water production. When originally completed recently, the 13,061 ft. wildcat flowed 240 bbl. daily

Exploration This Week

Appalachian	297
California	297
Oklahoma	299
Tennessee	300
Canada	302
Louisiana	304
New Mexico	305
Rocky Mountain	306
Texas	306
Michigan	314
Successful Wildcats	314

IF you change your address

please be sure to let us know promptly. It takes time to correct the stencil addressing plate. And we don't want you to miss copies of THE JOURNAL.

Also . . . . . .

be sure to give us both

(1) your OLD address
(including company)

and

(2) your NEW address

We need them both to make the change. Also confirmation of your company connection and position.

The Oil and Gas Journal
Box 1260 Tulsa, Okla.

This is not an offering of these debentures for sale, or an offer to buy, or a solicitation of an offer to buy, any of such debentures. The offering is made only by the prospectus.

$20,000,000

Dresser Industries, Inc.

4⅛% Subordinated Debentures, due March 1, 1977

(Convertible until March 1, 1967)

Dated March 1, 1957 Due March 1, 1977

Price 100% and accrued interest

Copies of the prospectus may be obtained from the undersigned only in states in which the undersigned is qualified to act as a dealer in securities and in which the prospectus may legally be distributed.

Blyth & Co., Inc.

March 14, 1957.

why 100% WAUKESHA

SCHAFER DRILLING COMPANY

Liberty Bank Building
OKLAHOMA CITY, OKLAHOMA
Tel. REgent 9-1607

Harry J. Schafer, President

November 1, 1956

Waukesha Motor Company
Waukesha, Wisconsin

Gentlemen:

In my many years as an Oil Producer, I have used almost all makes and types of applicable engines on my wells that were "on the pump." Through the years Waukesha engines have done the most all around satisfactory job for me. I also noticed that the large majority of drilling contractors, drilling wells for me, had Waukesha engines on their drilling rigs.

Therefore, in 1952 when I decided to form my own drilling company, naturally I equipped my first rigs with Waukesha engines. Due to their excellent performance and economy of operation, I have had all of my rigs similarly equipped.

I am proud to say that we are a 100 per cent Waukesha customer. My congratulations on a truly fine product.

Very truly yours,

Harry J. Schafer

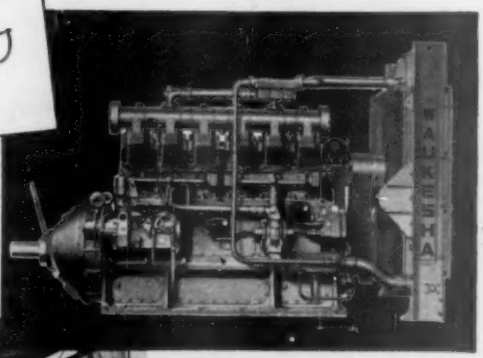
HJS:ah

Harry J. Schafer
President
SCHAFER DRILLING CO.
can tell you

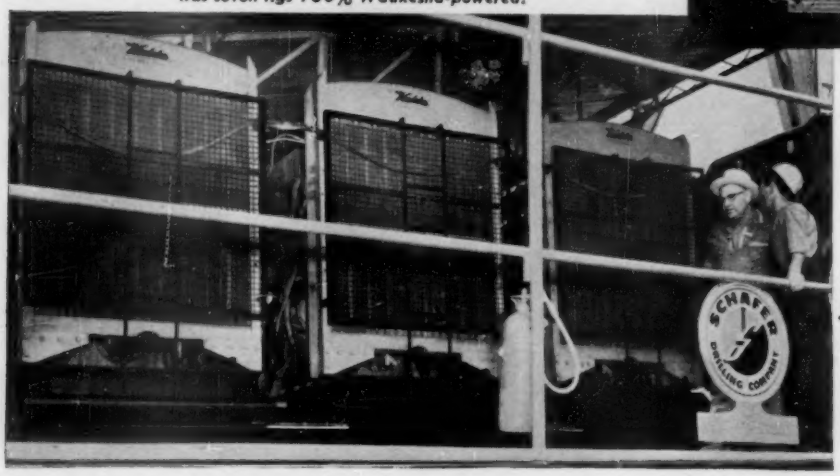
WAUKESHA
Engines and Power Units up to 1135 hp

LP Gas • Natural Gas
Normal and
Turbocharged Diesels

SEND FOR BULLETIN 1079



Schafer Rig No. 5, drilling at 8,111 ft., Cook No. 2 well, Cement, Okla. This rig, a Unit U-40, has two pumps. Toolpusher Jack (R. J.) Hinchey and Jim Saylor, daylight driller, look pleased with its 3 Waukesha LROU gas power units. Schafer Drilling Co. has seven rigs *100% Waukesha-powered.*



WAUKESHA Model LRORBU GAS POWER UNIT—counterbalanced crankshaft, high compression, overhead valve, six cylinders, 8½-inch bore x stroke, 2894 cubic inch displacement. *Send for Bulletin 1560.*

WAUKESHA MOTOR CO.
WAUKESHA, WISCONSIN
New York • Tulsa
Los Angeles

329

net of 30.3°-gravity oil from all intervals between 11,850-12,420 ft., but it also produced 960 bbl. of water daily. A plug has been set at 12,335 ft. and Reserve is now testing the interval between 11,850-12,300 ft. This wildcat, 67-18 Butler Wehr, is located in SW SE 18-11n-19w, about 2 miles north of the community of Wheeler Ridge in Kern County. It is the deepest test drilled by Reserve in this area where the company recently added more than 2,000 acres to its holdings.

New Wheeler Find

Richfield Oil Corp. tested 23-27 ROC KCL G for 870 bbl. daily of 36.3°-gravity crude from 8,649-8,811 ft. for an apparent new fault block discovery in NW NW 27-11n-20w, on the northeast edge of Wheeler Ridge field, Kern County. Initial production was flowing through a 48/64-in. choke.

Riverdale Discovery

Carr, Wrath & Payne, operators, gave the northwest area of Riverdale field, Fresno County, a a new pool discovery recently with completion of 21A-7 McCarthy in NW NW 7-17s-19e. The wildcat flowed 260 bbl. daily of 33.1°-gravity crude through an 8/64-in. choke. The producing interval is in the Miocene at 6,350-6,770 ft. The operators report they have two other shallower zones behind pipe.

OKLAHOMA

NORTHWEST OKLAHOMA

New Pay Indicated In Laverne District

The Laverne district of Harper County has an apparent new-pay discovery at Gulf Oil Corp. 1 Hicks in NE SW 7-26n-24w. The well tested up to 4,000 M.c.f. of gas per day on a drill-stem of the Wabaunsee-Virgil (Pennsylvanian) at 4,242-4,325 ft.

SOUTHWEST OKLAHOMA

Number Seven Staked In Deep Knox Area

The seventh well in the expanding deep campaign in Grady County's Knox field was staked at British-American Oil Producing Co. 1 Baker, 50 ft. north and east of C 33-3n-5w.

There are three other wells drilling in the deep area, and Pan American Petroleum Corp. is drilling just east of the 1 Baker.

British-American just completed the state's deepest producer at Knox at its 1 Reed. The well was completed flowing gas-distillate from third Bromide sand at 15,645 ft. The other completed well was the 2 Harrison, a 1956 discovery which also gave the state a new deep producing-depth record.

SOUTHERN OKLAHOMA

East Marietta Oil Creek Discovery Completed

The discovery well at East Marietta in Love County was completed flowing 174 bbl. of condensate on 11/64-in. choke and 2,530 M.c.f. of gas per day from perforations in the Oil Creek-Ordovician at 8,756-57 ft. It is The Texas Co.'s 1 Westheimer, NW SW NW 17s-3e.

West Moore Extension Flows Unconformity Oil

Continental Oil Co. 1 Rose, C SE NW 21-10n-3w, West Moore extension well in Cleveland County, flowed 172 bbl. of oil in 8 hours on open 2-in. tubing from perforations in the Unconformity sand at 7,719-51 ft.

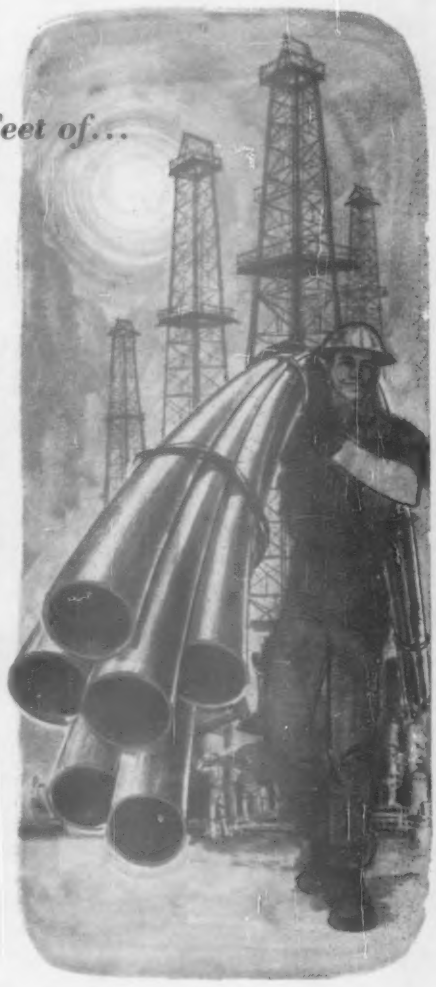
Over One Million Feet of...

KRALOY

HIGH-IMPACT

PVC PIPE

in oil-country use today



This proves that there is no substitute for Kraloy experience.

KRALOY is the most experienced manufacturer of PVC plastic pipe for the petroleum industry. The first polyvinyl chloride lead line installed in this country—at Great Bend, Kansas—was Kraloy Pipe. Kraloy High-Impact PVC today is preferred by production men for maintenance-free service in lead lines and disposal systems. Kraloy customers use Kraloy High-Impact PVC pipe for lead lines, gas lines, and salt water lines because Kraloy normally eliminates (1) sulphur corrosion due to sour crude, (2) paraffin buildup, (3) corrosion and scale, (4) trouble from soil electrolysis.

YOU Benefit From KRALOY'S Quality Control

To insure quality control, random samples of Kraloy Plastic Pipe are tested daily in Kraloy's own laboratory for burst pressure, impact resistance, and tensile strength under standard ASTM specifications.

Kraloy Pipe is Sold Only Through Qualified Supply Stores

Warehouse stocks and sales representatives:

Great Bend, Kansas:
Robinson Oilfield Specialties Co.,
616 Main St.

Houston, Texas:
The Mott Company,
1719 McKenney St.

Tulsa, Oklahoma:
The Becker Sales Company,
2837 Sands Spring Rd.

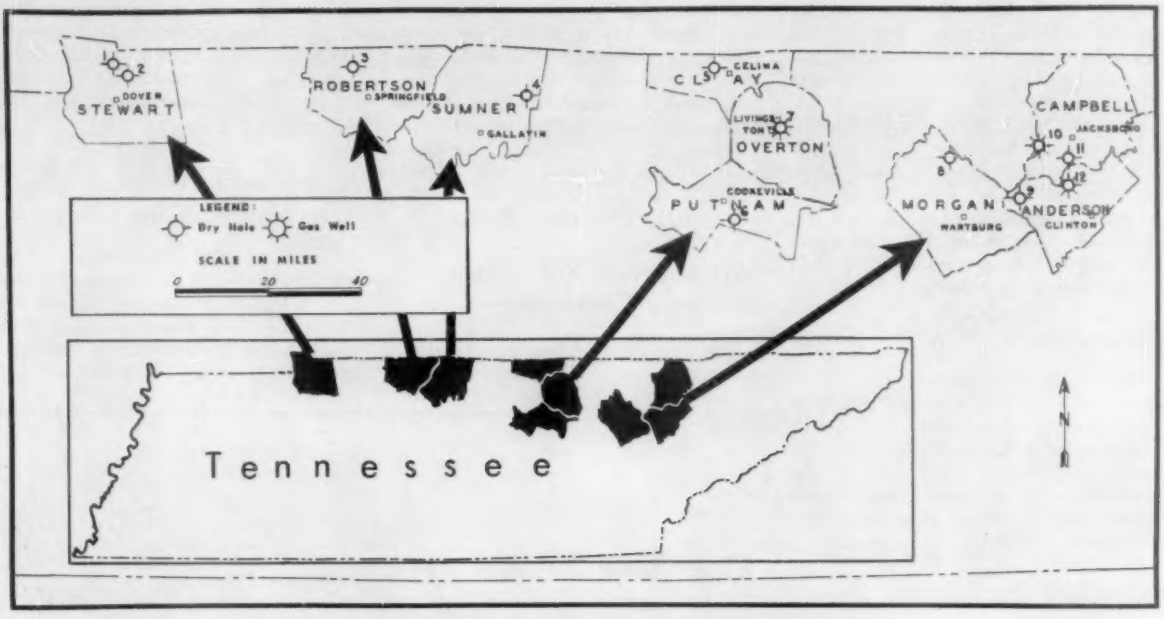
For case histories of actual Kraloy installations, cost comparison tables between Kraloy and other pipe, plus detailed instructions and specifications for all field uses, write to:

KP-102

KRALOY *plastic pipe co., inc.*

4720 East Washington Boulevard, Los Angeles, Calif.

Subsidiary of the Seamless Rubber Co., a Rexall Drug Co. Subsidiary



IMPORTANT WILDCATS drilled in Tennessee in 1956 are shown on this map.

With 21 tests completed in 1956 . . .

Tennessee's Development Picks Up Speed

by H. C. Milhous

TWENTY-ONE test wells were completed in 1956. Total exploratory footage was almost 34,000 ft. for the year, and five tests were drilling below 2,000 ft. as the year closed. Gas from two new wells is being used locally and one small oil well was brought in.

Development . . . Five of the 21 tests drilled during 1956 exceeded 3,000 ft. in depth but only one of these reached the Knox dolomite. The other four were drilled to test the gas possibilities of the Chattanooga shale and one of them was extended to the top of the Stones River group.

Author is senior geologist, Tennessee Division of Geology.

Of the remaining tests drilled, 6 were less than 2,000 ft. deep and 10 were less than 1,000 ft. in depth. All were located in the northern half of Middle Tennessee with no completions in either the East or West Tennessee provinces, but a shallow test was temporarily shut down in West Tennessee at the end of the year.

In Anderson County, Columbian Carbon Co. plugged its 1 Tennessee Mining & Manufacturing Co. at 3,238 ft. after unsuccessful attempts to complete it as a gas well. The 1 East Tennessee Iron & Coal Co. in Campbell County was temporarily capped with a potential of 40,000 cu. ft.

Also in Anderson County, W. W. Mausch's 1 Coal Creek Mining & Manufacturing Co. was reported to be producing gas from the Chattanooga shale for a local market. In Campbell County the W. F. Lacy 1 Lindsey Land Co. cut the Chattanooga at 3,213-61 ft. but did not report a show of gas.

Two tests temporarily shut down at the end of the year had reported good shows of gas in the Chattanooga shale. These were the Columbian Carbon

TABLE 1—IMPORTANT WILDCATS DRILLED IN 1956

Map No.	County	Operator	Location Sec.-T.-R.	Total depth (feet)	Surface formation	Deepest zone tested	Remarks
1.	Stewart	Haines-Gulf Oil Co.	23-B-20e	1,300	Miss.	Sil.	D & A
2.	Stewart	Haines-Gulf Oil Co.	7-A-21e	1,350	Miss.	Ord., M.	D & A
3.	Robertson	Kemper & Anderson	22-B-31e	1,430±	Miss., M.	Ord., L.	D & A
4.	Sumner	C. J. Conklin	22-A-39e	1,505	Ord., M.	Knox, U.	D & A
5.	Clay	Reecer & Mozier	24-B-48e	890±	Miss., L.	Ord., L.	D & A
6.	Putnam	Polkinghorn et al.	17-5s-49e	1,726	Miss., L.	Knox, U.	D & A
7.	Overton	H. B. Nevans	7-2s-51e	600	Miss., L.	Ord., M.?	Gas—used locally
8.	Morgan	Ben Tate et al.	15-3s-59e	5,517	Penn., L.	Knox, L.	D & A
9.	Anderson	Columbian Carbon Co.	3-5s-62e	3,238	Penn., L.	Ord.-Sil.	D & A
10.	Campbell	Columbian Carbon Co.	4-3s-63e	3,811	Penn., L.	Ord., M.	Gas—may utilize
11.	Campbell	W. F. Lacy	18-3s-64e	3,300	Penn., L.	Ord.-Sil.	D & A
12.	Anderson	W. W. Mausch	19-4s-64e	3,090	Penn., L.	Miss., L.?	Gas—used locally

BP DRILLS 1,000,000 FT. IN BRITAIN

TWENTY YEARS AGO The British Petroleum Company started the search for oil in Britain and began production in 1939 to make a timely addition to wartime supplies. Now more than a million feet have been drilled in Britain by the BP Group.

Two of the producing oilfields were discovered since the war. These are at Plungar in Leicestershire and Egmanton, Nottinghamshire.

In 1956 some 500,000 barrels of crude oil came from Britain's 214 producing wells—most of them in the Nottingham area—bringing up the total quantity produced from English oilfields to 7,250,000 barrels. A very worthwhile contribution to the ever-growing need for oil and oil-products.

The BP Shield is the symbol of the world-wide organisation of

The British Petroleum Company Limited

BRITANNIC HOUSE · FINSBURY CIRCUS · LONDON, E.C.2.

Co. 2 East Tennessee Iron & Coal Co. in Campbell County and the W. W. Mausch 1 Pruden in Claiborne County.

One of the most interesting tests of the year was the Ben Tate et al. 1 Baker-Pemberton in Morgan County. This test encountered the Knox at 3,704 ft. and was abandoned in the Copper Ridge dolomite at 5,517 ft. A good show of gas was recorded at 1,411 ft., but no shows were observed below that point.

In Stewart County, Gulf Oil Co. farmouts were drilled to 1,300 and 1,350 ft. to test the Silurian.

Eight tests were drilling or temporarily shut down at the close of the year. Godfrey L. Cabot, Inc., 1 Rocky River in southern Van Buren County was drilling below 4,900 ft. after testing approximately 2,050 ft. of the Knox.

Oil Production

Total oil production for the year was 8,675 bbl. A breakdown by counties follows: Clay County—1,276 bbl., Fentress County — 484 bbl., Scott-Morgan counties — 6,278 bbl., and Pickett County—637 bbl.

Gas Production

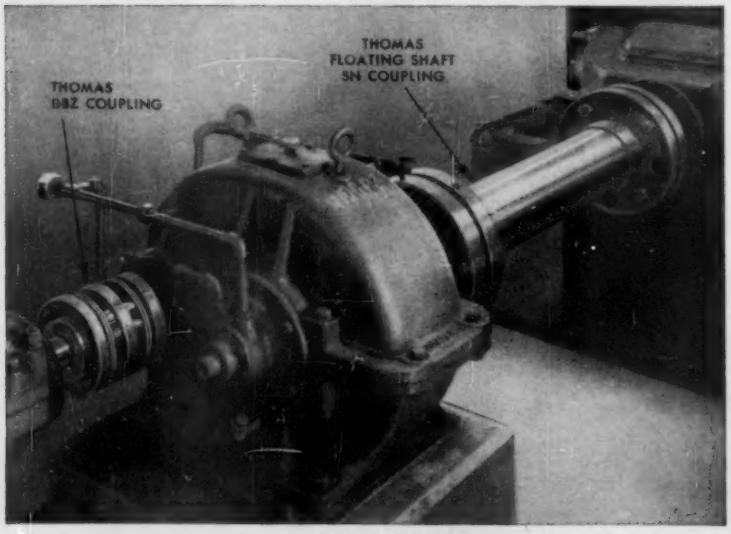
Total gas production was approximately 47,500 M.c.f. Production from wells in Morgan and Scott counties was 38,514 M.c.f. and production from Jamestown field in Fentress County was estimated at 9,000 M.c.f.

Acknowledgment

The author expresses his thanks for the assistance of W. D. Hardeman, state geologist of Tennessee, T. R. Pierce, senior geologist, Tennessee Division of Geology, and for the cooperation of the drillers, operators, and refiners who furnished valuable information.

THOMAS FLEXIBLE COUPLINGS

Give You Freedom From Coupling Maintenance



NO LUBRICATION NO MAINTENANCE NO WEARING PARTS

Future maintenance costs and shutdowns are eliminated when you install Thomas Flexible Couplings. These all-metal couplings are open for inspection while running.

They will protect your equipment and extend the life of your machines.

Properly installed and operated within rated conditions, Thomas Couplings should last a lifetime.

Under Load and Misalignment only Thomas Flexible Couplings offer all these advantages:

1 Freedom from Backlash Torsional Rigidity
2 Free End Float
3 Smooth Continuous Drive with Constant Rotational Velocity
4 Visual Inspection While in Operation
5 Original Balance for Life
6 No Lubrication
7 No Wearing Parts
8 No Maintenance

Write for Engineering Catalog 51A

THOMAS FLEXIBLE COUPLING COMPANY
WARREN, PENNSYLVANIA, U.S.A.

CANADA

ALBERTA

Red Earth Activity Stops Until Autumn

Weather and road conditions, which in the near future, will cut western Canadian exploratory and development work to a near standstill, has already effected one company. The discoverer of oil in the Red Earth Creek area of northern Alberta, Union Oil Co. of California, has suspended operations in that area until next freeze-up and the three rigs the firm had working for it during this season are all on their way out.

Because of the muskeg conditions of the terrain in that portion of Alberta, lying 82 miles east-northeast of Peace River townsite and 210 miles north-northwest of Edmonton city, it is impossible to move heavy equipment, in or out, during the spring and summer months, thus further drilling in this area isn't contemplated by Union until next October or November.

The company has added another two producers and one probable producer during the past winter drilling one success 1 mile due east of the original strike, another oil well lies 1 mile north and ¼ mile east of the initial follow-up and their probable producer is 2½ miles north and ¼ mile east of that. However, the probable producer, will need further testing on it, although a pipe recovery, during drill-stem test operations, gave up 2,800 ft. of clean light-gravity oil.

This development the past winter has also given up some disappointments as another four wells were drilled to completion depth into the Granite Wash without giving up commercial showings. Those wells do not influence the oil structure, however, as they lie up to 7 miles away from the initial discovery.

Drilling to date in this area has been carried out fully on Petroleum and Natural Gas Reservation No. 2349, a

all-purpose packhorse FOR OFFSHORE RIGS!

Tough, versatile, tremendously dependable, this offshore supply vessel — one of four built by Ingalls for Sea Service Incorporated—is indeed an "all-purpose packhorse" for the big offshore rigs! Capable of carrying 3,500 barrels of water — or two enormous stacks of 8" drill pipe — *plus* 2,000 gallons of drinking water and miscellaneous stores and equipment, she also boasts a pair of 516 h.p. Buda diesel engines. Able to maintain a speed of 11 knots, she is used to tow drilling barges on location, and as a standby tug. The know-how in the offshore drilling field depends on EQUIPMENT know-how; Ingalls has it, and is glad to help *you* with it! The Ingalls Shipbuilding Corporation cordially invites your inquiry.

DESIGNERS & BUILDERS
of Offshore Service Vessels, Drilling and Commercial Barges, Tankers, Naval and Merchant Vessels

THE INGALLS SHIPBUILDING CORPORATION

EXECUTIVE OFFICES: Birmingham, Alabama
SHIPYARDS: Pascagoula, Mississippi; Decatur, Alabama
SALES OFFICES: New York, Washington, Houston, New Orleans, Philadelphia, Chicago, Atlanta

tract of 99,840 acres, only 1 of 14 held in the area by Union. This block is contained in an irregular spread stretching 28 miles south, 8 miles west, up to 20 miles east and as far as 78 miles north of the discovery hole.

Dual Gas Strike Reported at Sedalia

A Montana oil man, L. S. Stadler, has discovered gas production in two separate horizons at a wildcat test in the Sedalia area of Alberta, being drilled by him on acreage acquired from Okalta Oils, Ltd., and Canpet Exploration, Ltd. This strike, that found gas in both the Viking and detrital formations also gave slight shows of oil during Mississippian zone drill-stem tests. The operator of the well, however, did not deem those showings in any way commercial and is therefore plugging the well back to the detrital-gas producing horizon.

The success, Okalta-Canpet 11-24 Stadler, was drilled on LSD 11, 24-30-5w4, 90 miles east of Drumheller city and 25 miles northwest of Sibbald railpoint. Test to indicate success in the Viking covered an 85 ft. interval and flowed natural gas at maximum rate, 1,800,000 cu. ft. daily; while the latest discovery, in the detrital and taking in 25 ft. of that zone, gave up gas at a maximum daily rate of 2,160,000 cu. ft.

Gas Tested at Simonette River

An explorer without success up until now in the Simonette River area of northwest Alberta, Shell Oil Co., has finally come up with an indicated commercial showing while drill-stem testing at its fourth well in that area. This discovery hole, Shell-Explorers-Petrol 7-16 Simonnette, on LSD 7, 16-62-26w5, flowed gas to the surface at rate 4,000,000 cu. ft. daily from the Peace River sand formation. The gas flow was also reported as condensate bearing and sweet.

The well falls on acreage farmed out to Shell by Central Explorers, Ltd., and Petrol Oil & Gas Co., Ltd., and is 65 miles southeast of Grande Prairie and 80 miles northwest of Edson townsite.

Viking Gas Flows At Kaybob Wildcat

The final discovery made in Alberta during the past week was made by Phillips Petroleum Co. at a well it is drilling in the Kaybob area, 140 miles northwest of Edmonton city limits and 90 miles southwest of Grande Prairie. It is being drilled on acreage that Phillips acquired under a farmout agreement from the British American Oil Co., Ltd.-California Standard, Ltd., team and comprises a total of 92,160 acres contained in Petroleum and Natural Gas Reservation form.

This strike, Phillips 1 Kaybob, is being drilled on LSD 7, 22-64-19w5. It lies 12 miles northwest of the Cal-Standard-Gulf 5-35 Kaybob exploratory dry hole and is a little over 10 miles southeast of Pan-American's 1 Giroux Lake Gilwood sand oil discovery well.

Discovery horizon at this well was reported as the Viking sand and test evaluation in that sector gave up 6,000,000 cu. ft. of gas daily. Upon completion of the drill-stem test crew resumed drilling operations with the D2 formation at 12,000 ft. set as its objective.

POWERED by a small but extremely rugged Model BKN single cylinder Wisconsin Heavy-Duty Air-Cooled Engine (6.8 hp.), this pumping unit circulates and recirculates bad oil or bottom settlings through the treating plant, to pull from the test tanks and general transfer work. The unit comprises a Wisconsin BKN Engine with reduction assembly, direct-connected to a Roper rotary pump, and is operating on a major oil company's 14,500 ft. well in Grady County, Okla. The 185 ft. mast in the background is one of the most modern and highest in deep well drilling.

In Big League operations such as this, involving possibly an investment of a quarter of a million dollars or more, the engineers must of necessity investigate and specify only the most select equipment to best meet the job requirements. Wisconsin Air-Cooled Engines score high on the "select" list for every type of service within their horsepower range (3 to 56 hp.).

Wisconsin Air-Cooled Engines and Harley Sales Company units are specified as most compatible with the best equipment used in deep well operations . . . backed by service second to none! Let us prove it to your satisfaction.

WISCONSIN MOTOR Corporation
MILWAUKEE 46, WISCONSIN
World's Largest Builders of Heavy-Duty Air-Cooled Engines

WRITE TO HARLEY SALES CO.
619 SOUTH MAIN STREET • TULSA, OKLAHOMA
3420 McKINNEY AVENUE • HOUSTON, TEXAS
505 SOUTH MAIN STREET • WICHITA, KANSAS
OIL FIELD DISTRIBUTORS FOR WISCONSIN ENGINES AND ALL TYPES OF UTILITY UNITS

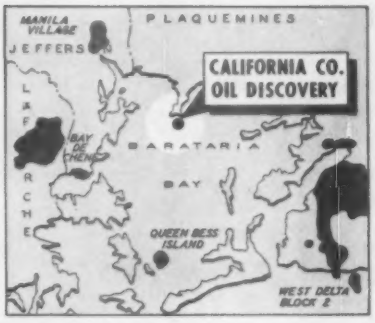
A 7-6087-½-I

LOUISIANA

SOUTH LOUISIANA

Plaquemines Discovery Uncovers New Oil Field

California Co. has a new oil discovery in southwestern Plaquemines Parish. It is in the Saturday Island



LOCATION of California Co.'s new oil-field discovery (indicated) in Saturday Island area of Barataria Bay, in southwestern Plaquemines Parish.

area, in the upper part of Barataria Bay, near the Jefferson Parish line.

Location, on State Lease 3035, is about 6 miles southeast of Manila Village field, in Jefferson Parish, and about the same distance east of Bay De Chene field, on the opposite side of the bay, in Lafourche Parish. The large Lake Washington field, in the coastal marshes, is about 10 miles southeast.

Production is from perforated intervals at 10,350-57 ft. and 10,364-70 ft., in Miocene sand. Oil flow, tested through small chokes, was at the rate 198 bbl. per day with gas-oil ratio of 972 cu. ft. per barrel.

Hole was drilled to 11,250 ft.

Lafayette Wildcat Makes Gas-Condensate Producer

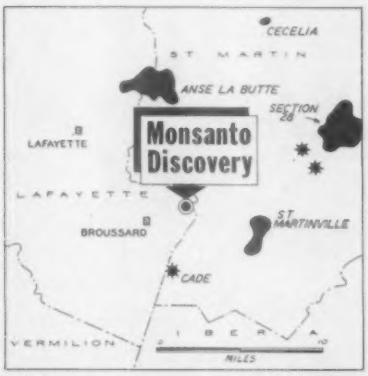
Monsanto Chemical Co., operating through its Lion Oil Co. division, reports completion of a prolific condensate producer in a wildcat discovery 2½ miles northeast of Broussard, on the eastern edge of Lafayette Parish.

Production of the discovery well, 1 Tortue, through ¼-in. choke, was gaged at 280 bbl. of 51.5°-gravity condensate and 2,450,000 cu. ft. of gas per day.

Completion is from casing-perforated interval at 11,448-54 ft. Testing of three deeper zones also gave indications of commercial oil, gas-condensate, or gas production. Deepest pay tested was at 13,378-13,404 ft. Total depth is 13,519 ft.

A 50 per cent interest in the well, and the 5,800-acre block on which it is located, is owned by Texas Pacific Coal & Oil Co., Rowan Oil Co., and Rowan Drilling Co., Inc.

Location is within 6 mile of the St. Martin Parish line. Nearest production is in St. Martinville field, about 4 miles southeast, in the latter parish. Broussard is about 6 miles southeast of Lafayette.



GAS-CONDENSATE discovery by Monsanto Chemical Co. in eastern Lafayette Parish.

Production Assured in Calcasieu Wildcat Test

Gas-condensate production is indicated in a wildcat drilled by W. E. Walker in southeastern Calcasieu Parish. The prospective discovery well, 1 Walker-Corbello, in 26-11s-7w, is 1 mile north of the Cameron Parish line, and about 2¼ miles northeast of West Chalkley field, in the latter parish. It is about 3 miles east of a gas-condensate discovery well completed last July by Sun Oil Co. It opened North Chalkley field.

Walker's well tested casing-perforated interval at 11,275-85 ft. It got a flow of 3,000,000 cu. ft. of gas per day through ¼-in. choke. Liquid recovery was at the rate of 50 bbl. per day. Pressure was 3,400 psi.

Sun's discovery well, 1 Stanton, is productive from perforations at 11,814-34 ft.

Vermilion Parish Proves Productive at North LeRoy

Buffalo Oil Co.'s deep wildcat test 12 miles northwest of Abbeville, in northern Vermilion Parish, flowed at the rate of 3,700,000 cu. ft. of gas and 80.4 bbl. of high-gravity condensate per day while testing perforations at 12,360-75 ft. Flow was through an adjustable choke, recording pressure of 3,100 psi.

A shallower sand, at 12,250 ft. will be tested before the well is completed. The well, 1 Jewel Manes, was drilled to 16,003 ft.

Location, in 6-11s-3e, is 2½ miles southwest of the new Ridge field, across the line in southwestern Lafayette Parish. It is about 5 miles west of Maurice field, opened last year. Buffalo's discovery opens North LeRoy field.

NEW MEXICO

NORTHWEST NEW MEXICO

San Juan Bags Three New Discoveries

Exploratory success is picking up in the San Juan basin after a period of comparative quiet. Focal point of the new activity is San Juan County.

The most important new strike is El Paso Natural Gas Co.'s new Gallup field, 6 miles northeast of the Bisti trend. The 1-F Sullivan, NW SE SW 32-27n-12w, flowed 525 bbl. of oil and 415 M.c.f. of gas per day on 28/64-in. choke from perforations in the Gallup sand at 4,850-60, 4,964-81, and 4,990-5,025 ft. Location is between Blancho and Bisti fields.

This El Paso discovery is one of the most significant developments in the Gallup play since Bisti itself was opened. There has been very little drilling off the northern end of the Bisti trend. A few gas wells were completed north of the trend. The new Gallup oil field may signal the opening of another northwest-southeast trend north of the main Bisti producing area.

In Rio Arriba County's southwestern corner, Harrell Budd 1 Dunn, C SW SW 10-23n-7w, pumped 47 bbl. of oil per day to open another Gallup producing area. Location is 7 miles east of oil production and 8 miles southwest of Blanco field gas production.

Gulf Oil Corp. has a new Gallup sand gas discovery at 1 Blackrock-Federal in C NW NW 20-26n-11w, San Juan County. This well flowed 705 M.c.f. of gas per day, opening first Gallup sand production in the area.

The biggest Gallup sand discovery news in the Bisti area of New Mexico since Carson field was discovered last year is El Paso Natural Gas Co.'s 525-bbl. discovery at 1-F Sullivan, off the beaten Gallup trail in San Juan County. The discovery is between Blanco gas production and Gallup sand oil production in the Bisti trend.

ROCKY MOUNTAIN

UTAH

Offset to East Desert Creek Discovery Announced

A 5,700-ft. southwest offset well was announced last week at new East Desert Creek field in San Juan County, Paradox basin.

Continental Oil Co. will drill the 1 Indian in C SW NE 27-41s-24e, as a follow-up to Davis Oil Co.'s 1 Navajo "A" discovery in C NE NE 27-41s-24e. That well flowed oil at the estimated rate of 30-45 bbl. per hour on tests. The test was at 5,510-90 ft. in the Paradox-Pennsylvanian.

Rank Paradox Test Slated in San Juan

Reynolds Mining Co. will drill a rank wildcat 6 miles north of Aneth field in the Paradox basin. The new try is the 2 Hatch Unit in NE SW 9-39s-24e, San Juan County.

Drilling Continues at Navajo "H" Prospect

Drilling is below 6,223 ft. at the 1 Navajo "J," indicated Continental Oil Co. discovery in C SW SE 21-40s-25e, San Juan County. The wildcat had 900 ft. of free oil on a drill-stem test at 5,780-5,854 ft. Location is 3 miles east of Aneth and 5½ miles west of East Aneth, separated by two dry tests.

WYOMING

More Gas Reported at Deep Oregon Basin Well

Ohio Oil Co.'s deep test at Oregon Basin field, Park County, got 3,500 M.c.f. of gas per day on the latest drill-stem test at 6,112-44 ft. The 22 Samuel, C SW NW 32-51n-100w, Park County, tested the Flathead of Cambrian age. Another test is being taken at 6,144-59 ft. Earlier, a test at 5,746-70 ft. recovered gas at the daily rate of 3,271 M.c.f.

MONTANA

Outlook Report

Here are the details on the two wildcats drilling near Sheridan County's new Outlook field in northeastern Montana:

...Amerada Petroleum Corp. 1 Ruegsegger, C NE NE 24-36n-52e, is drilling in the Devonian-Duperow at 7,940 ft.

This well is 2 miles northwest of the 1 Tange, field discovery well, which was completed early this year flowing 2,742 bbl. of oil daily from the Silurian. That well had 18 ft. of pay.

...Amerada i Loucks, 4 miles southwest of the discovery well in C NE SW 35-36n-52e, is drilling in the Cambrian below 10,250 ft.

The well tested the Red River-Ordovician, recovering 30 ft. free oil, 3,446 ft. of gas and oil-cut fluid, 30 per cent oil, including a 2,440-ft. water cushion and 372 ft. mud-cut oil. A Silurian test got 72 ft. free oil, 1,830 ft. of oil and gas-cut water, and 680 ft. of oil and gas-cut mud.

Production Casing Set At Delphia Confirmations

Production casing is set to the confirmation prospect to new Delphia field in Musselshell County. Amerada 1 Sudan, C SE SW 23-9n-27e, recovered 720 ft. of oil and 360 ft. of heavily oil and gas-cut mud on a drill-stem test in the Amsden.

This well is the northwest offset and extension try to the Amsden discovery, 1 Goffena, which was completed recently for 554 bbl. of oil per day from perforations at 6,280-6,300 ft.

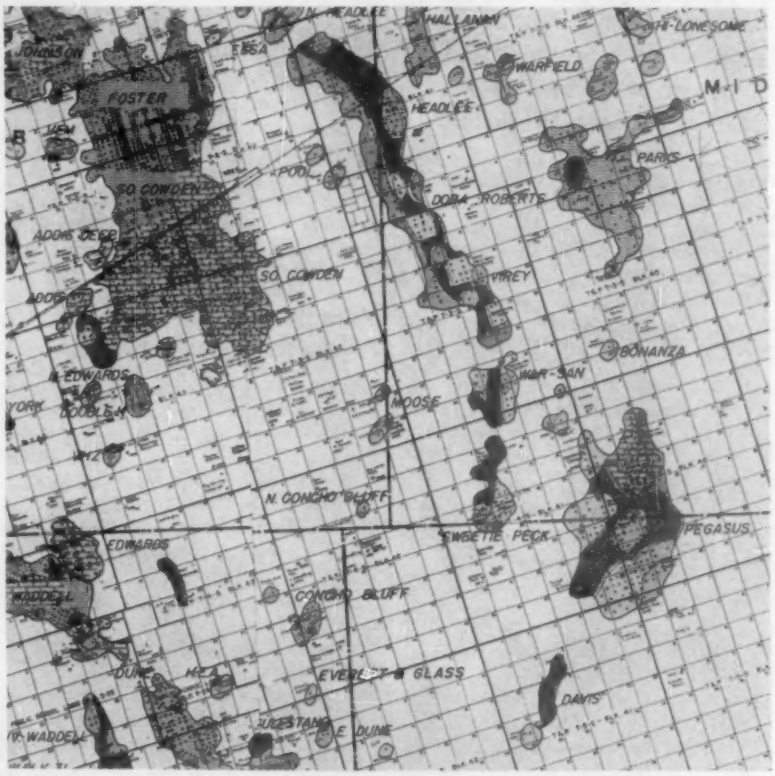
Glacier Discovery

Flank Oil Co., Waggoner & Lansford and U. S. Smelting, Refining & Mining Co. recovered 25 bbl. of oil in 1 hour on drill-stem test at the 1 Bugbee, NW SE SW 6-33n 6w, Glacier County. Gas flow was 1,300 M.c.f. daily. Production is from Lodgepole.

TEXAS

New Producing Formation Map Off the Press

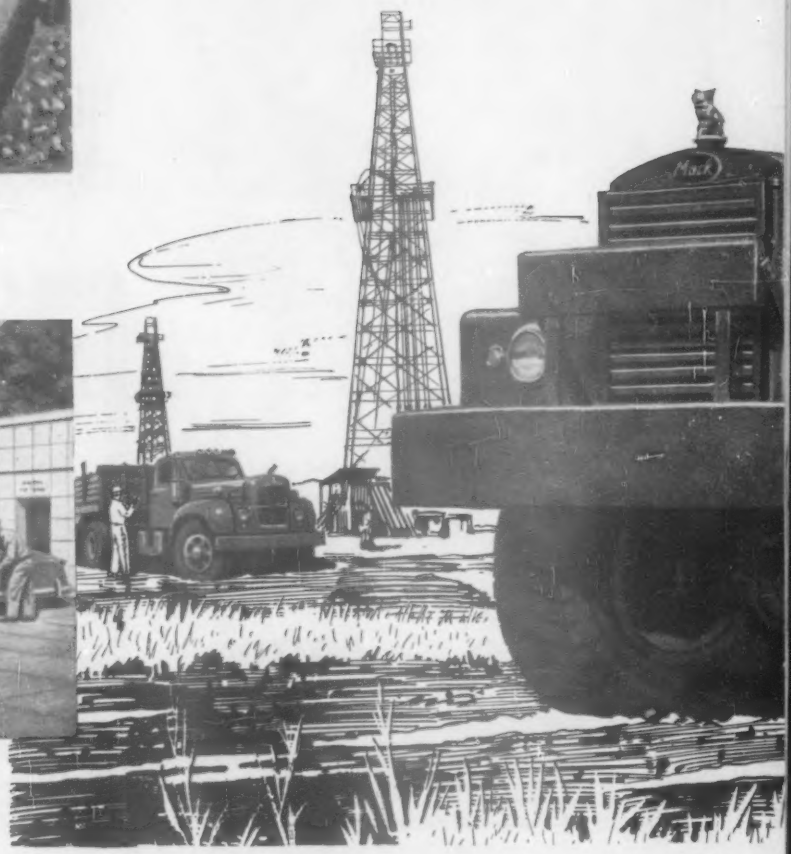
Southwest Mapping Co., Fort Worth, has issued the second edition of its Executives' Map, showing producing formations of the Permian basin. Production of each formation is shown by different colors, which are superimposed on a base map showing sections, surveys, towns, drilling wells, dry holes, and other pertinent data. Map posting is up-to-date as of February 1, 1957. Scale is 4 miles to 1 in. The map comes in two parts, north and south. Each size is 32 by 48 in., which can be matched together to make a wall map measuring 48 by 66 in. The area covered is the Periman basin of Southeast New Mexico and West Texas.



Reproduction of a small portion of producing formation map. Difference in shaded areas of fields show how color is used to denote the producing formations.

Pipe laying is a heavy hauling job where the unmatched stamina and performance of Macks pay off—especially over rugged terrain where the going gets really tough.

When it comes to volume hauling, Macks have an industry-wide reputation for economy and the ability to maintain 'round-the-clock delivery schedules.



To make the tough jobs easier...

...especially the challenging, heavy-duty hauling jobs . . . Macks are favorites throughout the petroleum industry. From drilling operations to fuel delivery, you'll find Macks working with top operating economy at the lowest cost per mile and with a minimum of down time. Hub-deep mud, rough terrain, grueling 'round-the-clock service—whatever the job, Mack has the unit that's engineered and built with the thoroughness and precision needed for dependable, cost-saving operation.

Mack makes more of its own components—engines, frames, axles, transmissions—than any other heavy-duty automotive manufacturer. To you, this means assurance that Mack components are made of the finest materials and designed for incredibly long and dependable performance.

Mack Diesel and Gasoline Engines—up to 206 hp with unequaled records for fuel economy and endurance.

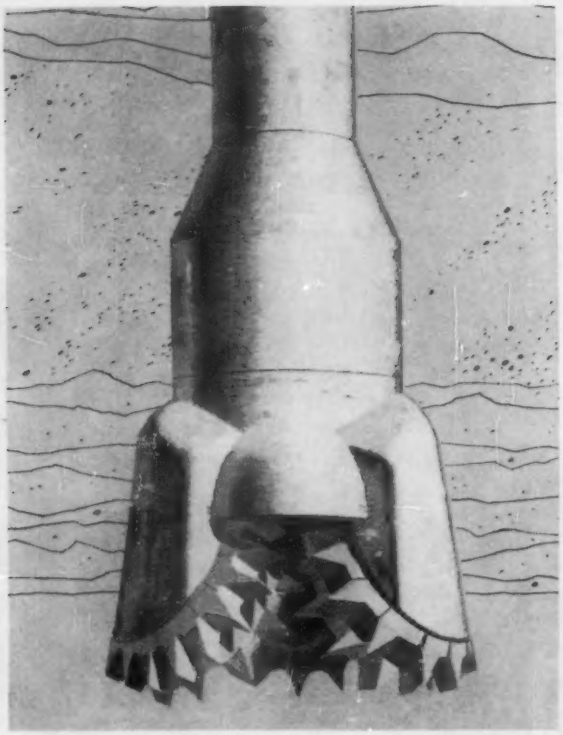
Mack Balanced Bogie with Power Divider—the flexible, 4-wheel rear-axle drive that delivers power to the wheels with traction.

Mack Transmissions—models up to 20 speeds . . . acknowledged as the industry's finest, most durable . . . featuring evenly spaced ratios and exclusive Tetrapoid gears.

These are a few of the exclusive Mack features. Why not let your local Mack representative give you the story on the most complete line of heavy-duty trucks and tractors available today. Mack Trucks, Inc., Plainfield, New Jersey. In Canada: Mack Trucks of Canada, Ltd.

MACK
first name for
TRUCKS

4796



LET'S GET TO THE BOTTOM
of your financing problem

The quickest, most profitable way to solve any oil production financing problem is to bring it directly to the Oil Department of Republic National Bank of Dallas. Here is a pioneer oil bank of the Southwest . . . the South's largest staff of petroleum experts, serving an ever-increasing number of producers with the kind of counsel and guidance that always asks first . . .

WHAT CAN *WE* DO FOR *YOU?*

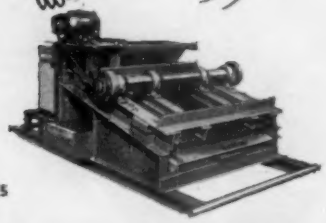
REPUBLIC National BANK of Dallas

MEMBER FEDERAL DEPOSIT INSURANCE CORPORATION

CAPITAL AND SURPLUS $75,000,000 LARGEST IN THE SOUTH

HUTCHISON MANUFACTURING CO.
6609 AVENUE U, HOUSTON 11, TEXAS

NEW MODEL RUMBA DE-SANDER



ALSO REMOVES SHALE

ALWAYS IN OPERATION WHEN PUMPS ARE RUNNING

NEW KINZBACH SPEEDMILLS *Slash* DOWN-HOLE CUTTING TIME

UTILIZING TUNGSTEN CARBIDE PARTICLES that continuously renew their cutting edges, new Kinzbach Speedmills offer you faster, surer milling under even rugged down-hole conditions.

Kinzbach Speedmills require less torque for cutting . . . eliminate drill pipe wind-up . . . reduce shock on drilling string . . . are unaffected by heat generated by normal cutting action. The usual close control of speed and weight required in ordinary subsurface cutting operations is not necessary with Kinzbach Speedmills.

Types available for every down-hole milling problem.

Type 154 Speedmill

Type 155 Speedmill

Type 156 Speedmill

Type 159 Speedmill

KINZBACH TOOL CO INC

Export Office: 74 Trinity Pl. New York, N. Y.

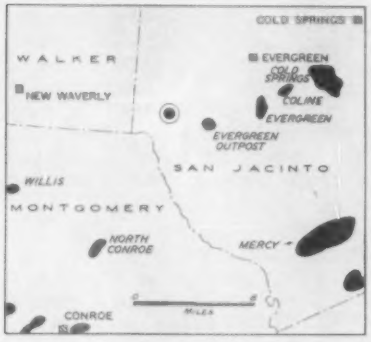
KINZBACH TOOL CO., INC. • P. O. BOX 277 • HOUSTON, TEXAS

TEXAS GULF COAST

Wilcox Produces Again In San Jacinto County

Western San Jacinto County is the scene of another Wilcox discovery.

The discovery is by J. C. Barnes and Cities Service Oil Co., joint operators, at their 1 Johnson, completed with a calculated open-flow potential rating of 4,600,000 cu. ft. of wet gas per day.



OLD WAVERLY area (indicated) in southwestern San Jacinto County, scene of new Wilcox discovery.

Location is 15 miles southwest of Cold Springs, and about 2 miles from the Walker County line, on the west, and about the same distance from the Montgomery County line, on the south. It is about 10 miles east of New Waverly, in Walker County.

Wilcox pay is perforated at 11,530-35 ft. It is hole drilled to 12,015 ft. Gas carried 48.1°-gravity condensate in the ratio of 72,700 cu. ft. of gas per barrel of liquid. Flowing pressure through 5/32-in. choke was 3,415 psi. with flow rate of 1,560,000 cu. ft. of gas per day.

Nearest other production is in the Evergreen area, about 3 miles southeast. Tentative designation of the new area is Old Waverly.

Caplen New-Pay Opener Records Large Gas Flow

The Texas Co. has completed a well in the Caplen area, on Bolivar Peninsula, Galveston County, with a calculated open-flow potential 340,000,000 cu. ft. of gas per day.

The well, 1 Merrill NCT-1, 7 miles southwest of Gilchrist, was drilled to 8,450 ft., but production is from a basal Miocene sand, perforated at 6,034-40 ft.

The sand is a new pay for the field, discovered in 1939 by Sun Oil Co. and productive of oil and gas from a multiplicity of Miocene and Oligocene sands. Productive area extends across the

FLINT
STEEL CORPORATION
TULSA - - - - - - - - MEMPHIS

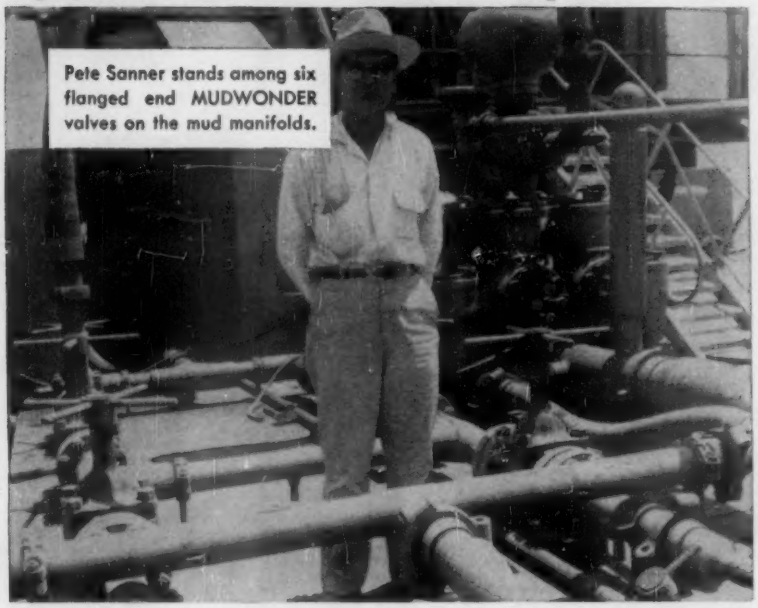
This emblem on fabricated steel is assurance that it has been fabricated in compliance with industry codes. The facilities and personnel to fabricate products in strict accordance to customer's specifications.

FABRICATED REINFORCING STEEL
STEEL WAREHOUSE DISTRIBUTORS
FABRICATED STEEL PLATE
FABRICATED GALVANIZED STEEL
FABRICATED STRUCTURAL STEEL

CONCRETE REINFORCING STEEL INSTITUTE C.R.S.I.
AISC
AMERICAN STEEL WAREHOUSE ASSOCIATION

for over 40 years
FLINT STEEL CORPORATION
TULSA . . . MEMPHIS

Tips on Mud Valves for Toolpushers...



Pete Sanner stands among six flanged end MUDWONDER valves on the mud manifolds.

New Oil Rig Equipped With MUDWONDER For Substantial Operational Savings

by Pete Sanner, Toolpusher, Rig #77
Nichols Drilling, Inc., Duncan, Oklahoma

MUD valve problems? We don't expect any on our new Rig #77. It is 100% equipped with Rockwell-Built MUDWONDER mud valves.

This is not Nichols' first experience with the MUDWONDER. Our company has been using them altogether for some time. Our records verified reports we got from crews in West Texas, the Gulf Coast, and Oklahoma. Everyone said the MUDWONDER is easier to operate, requires much less maintenance, holds pressure drop tight, and has longer service life.

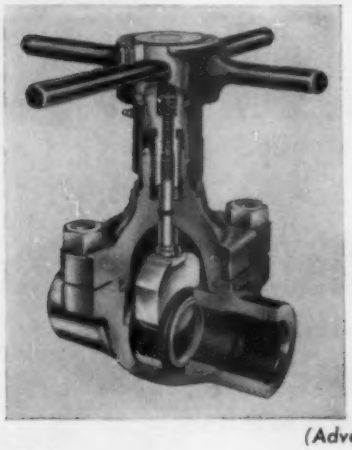
So, when we ordered our new rig, we specified MUDWONDER mud valves throughout. These valves cost the same as other commonly used mud valves, but we will realize substantial savings on operating costs. In fact, the MUDWONDERS have not cost one cent in downtime, labor, or parts during our first six months drilling.

But, if maintenance or part replacement is required, it can be done without special tools while the crew makes a connection. The one-piece MUDWONDER body keeps mudlines intact at all times. Downtime can be avoided.

Crewmen, too, highly recommend MUDWONDER valves as a solution for troublesome mud valve problems. MUDWONDER valves are built in 2", 3", and 4" sizes with screwed or flanged ends for 2000 psi WP (4000 psi test) and 3000 psi WP (6000 psi test).

See favorite oil field supply store for complete information, or write Edward Valves, Inc., subsidiary of Rockwell Manufacturing Company, East Chicago, Ind.

MUDWONDER cut-away view shows the double thread construction, separated stainless stem and chromed gate with "T" slot connection and the one-piece seat insert with the Buna-N molded integrally over the steel wear rings.



(Advertisement)

width of the peninsula into East (Galveston) Bay on the north, and into the Gulf of Mexico on the south.

Gas in The Texas Co.'s well carries a trace of 44.2°-gravity condensate. Shut-in pressure is 2,397 psi.

SOUTHWEST TEXAS

Vicksburg Produces in Brooks County Discovery

Vicksburg sand is proving productive of gas and condensate in a wildcat drilled by The Texas Co. in southwestern Brooks County. The discovery well, 18 McGill Brothers NCT-1, is about 2 miles east of the large Kelsey (Deep) field. It is about 16 miles southwest of Encino, and just north of the Starr County line.

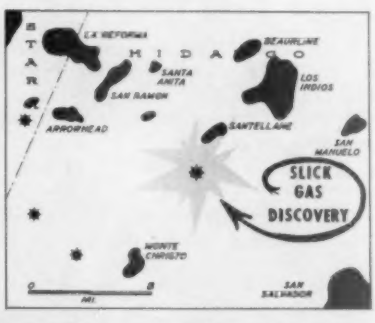
Vicksburg pay is perforated at 7,254-68 ft. Tested through ⅝-in. choke, the well flowed at the rate of 1,300,000 cu. ft. of gas and 20 bbl. of condensate per day with pressure of 1,900 psi. Shut-in pressure is 2,825 psi.

Santellana Step-Out Test Opens Deeper Sand Field

Slick Oil Corp. and W. C. Dunlap, Jr., report completion of their 1 Arcadio Guerra wildcat, 8 miles southwest of San Manuel, in western Hidalgo County, as productive of gas and condensate from Vicksburg perforations at 8,488-8,522 ft. It opens South Santellana field.

The well is rated good for 4,800,000 cu. ft. of gas per day, and has a gas-liquid ratio of 85,400 cu. ft. per barrel. Liquid is 54.5°-gravity condensate. Shut-in pressure is 3,965 psi.

Location is 2 miles southwest of Santellana field, discovered late in 1952 by F. P. Zoch, Jr. The latter field has three gas wells with production from Oligocene-Frio sands at depths of 6,382 to 6,920 ft.



DISCOVERY WELL of South Santellana field, in western Hidalgo County, completed by Slick Oil Corp. and W. C. Dunlap, Inc.

For low upkeep...

REX®

Roller Chains

This Walker-Neer C-37 Spudder is working on a 5800-foot "frac" job near Countyline, Oklahoma. If you look carefully at the close-up view (with chain guards removed), you can count six chain drives—more exactly, six Rex Roller Chain Drives.

The revolutionary Rex system of pitch control assures equal load distribution over all parts, and a special Rex manufacturing process imparts tremendous extra strength at the pin holes—both important factors in long chain life.

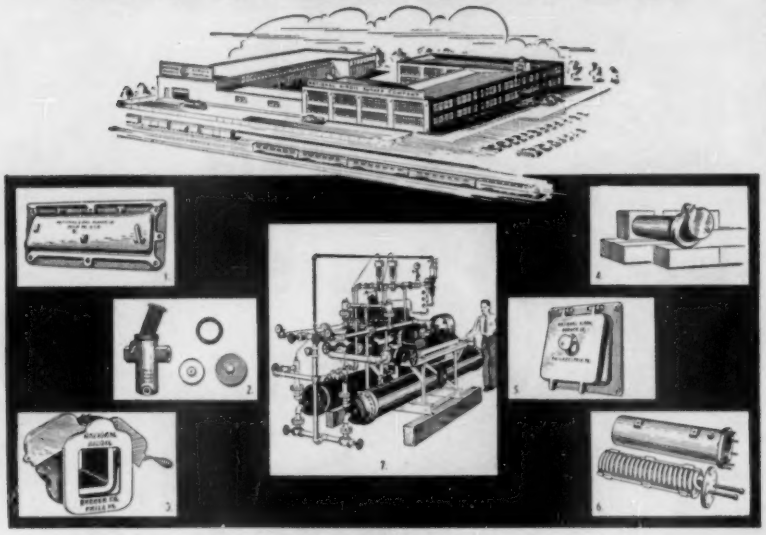
These features, plus the easy assembly and disassembly of Rex Oil Field Roller Chains, mean minimum down time. Your wise choice for this exacting service is always Rex Roller Chain. CHAIN Belt Company, 4619 W. Greenfield Ave., Milwaukee 1, Wis.

CHAIN BELT COMPANY

Milwaukee 1, Wisconsin

Oil Field Offices: Dallas • Houston • Los Angeles • New York
Export Offices: Milwaukee • New York

A Complete Line of
COMBUSTION
ACCESSORIES



for EVERY
INDUSTRIAL LIQUID FUEL-GAS INSTALLATION

1. Air Control Door and Frame, top hinged, ratchet type, heavy duty, for manual control. Surfaces are machined to a close fit.
2. Fuel Oil Suction Strainer, single type. Large basket area insures low pressure drop; cover and basket easily removed for cleaning.
3. Wide-View Peephole, safety, curtain type. Cobalt glass removed to show bearing surface for curtain. Curtain halves are interlocked—open simultaneously.
4. Ignition Port with Refractory Tile No. M896 . . . for use with standard 3" pipe. Also serves as a peephole.
5. Furnace Relief and Access Door, heavy construction, practically air tight. Door casting correctly weighted, lined with plastic refractory retained by imbedded grill; with observation port and cover.
6. Fuel Oil Heater, Self-Cleaning, Spiral Coil type. High oil velocity in coil, resultant turbulence prevents carbon formation. No internal connections or joints.
7. Fuel Oil Pumping and Heating Unit . . . Twin or Single Pumps, Steam driven, Electric driven or combination Steam-Electric, with Single or Double Fuel Oil Heaters and accessories for feeding oil at constant pressure and temperature.

. . . yes, just as we are proud of supplying the *right* liquid fuel or gas burning equipment (over 40 years experience throughout industry), so, also, are we proud of our full line of highest quality accessories to supplement your every combustion need. Within our modern, "daylight" factory, salesrooms and general offices NATIONAL AIROIL likes and adheres to the phrase, "nothing but the best"! We believe that our record speaks for itself . . . i.e.; the "right combination" for you in achieving maximum combustion economy is: NATIONAL AIROIL Fuel Oil, Gas or Combination Oil and Gas Burning Equipment; NATIONAL AIROIL Combustion Accessories; and, NATIONAL AIROIL Engineering Consultation.

May we be of help to you in accomplishing your particular installation or in solving that difficult problem?

Established 1912 — Incorporated 1917

CHEMICAL-PETROLEUM DIVISION

NATIONAL AIROIL BURNER CO., INC.

1236 EAST SEDGLEY AVE., PHILADELPHIA 34, PA.
Southwestern Division: 2512 South Boulevard, Houston 6, Texas

INDUSTRIAL OIL BURNERS, GAS BURNERS, FURNACE EQUIPMENT

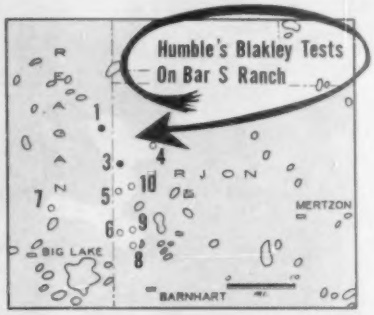
WEST TEXAS

Humble Sets Wildcats On Bar S Ranch

Humble Oil & Refining Co. has completed two small discoveries on the big Bar S Ranch of Reagan and Irion counties. A number of additional tests have been started on the Irion County side.

In Irion County, Humble 3 Blakley completed for a daily pumping potential of 32 bbl. of 31° oil, plus 26 bbl. of water, from Tannehill sand pay at 1,858-1,916 ft. Location is in 57-1-T&P Survey, 30 miles northeast of Big Lake.

Humble 1 Blakley in northeastern Reagan County made a 12-BOPD pumper from the San Andres pay at 1,774 ft.



Humble has had two discoveries and is drilling a series of tests on Blakley land of Bar S Ranch.

New starts . . . Wells numbered 8, 9, and 10 Blakley, are the latest in the series. All tests have been scheduled to 2,600 ft. and drilling was to start as soon as permits were granted. No. 8 is 1 mile northwest of the 2-well Peterson (San Andres) field and is in 189-1-T&P. No. 9 is 4½ miles northwest of Peterson field, in 161-1-T&P. No. 10 is 2 miles northeast of 5 Blakley, in 86-1-T&P.

Prospects . . . Humble 5 Blakley, 88-1-T&P, has recovered cores with oil shows between 1,734-2,034 ft., and was running electrical logs at last report. Humble 4 Blakely had scattered oil shows in cores between 1,754-1,858 ft.

The 170,833-acre ranch was purchased in 1954 from Sawyer Cattle Co. of Texas by William A. Blakley, Dallas. Price was said to be around $4,000,000.

Ellenburger Wildcat Has Oil Flow in the Wolfcamp

Pure Oil Co. 1 TXL, Ellenburger wildcat in northwestern Upton County,

DESIGNED FOR
. . . TESTED
AND PROVEN
IN THE OIL FIELDS

FIELDMASTER
BALL BEARING MOTORS

- VERMIN PROOF
- DRIP PROOF
- CORROSION RESISTANT
- MOISTURE PROOF
- FORCED AIR COOLED

Yes . . . all these features are combined in Fieldmaster Ball Bearing Motors to make them the leading power units in the oil country. Naturally there's a type and H.P. especially suited to fit your specific requirements.

Contact us for complete information on any motor requirement.

BETHLEHEM
SUPPLY COMPANY
TULSA, OKLAHOMA
Manufactured by
VALLEY ELECTRIC CORP.
ST. LOUIS 8, MISSOURI

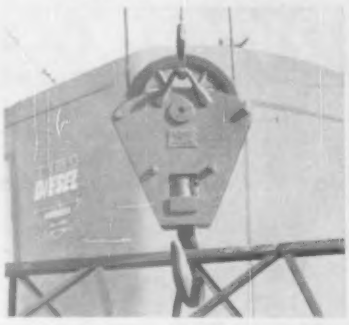
ROUGH ROADS—SUDDEN STOPS CAN'T LOOSEN THIS LOAD!

Truckers won't take chances with a load like this—it has to be tied down to stay! And experienced truckers know that a load secured with Lebus boomers can't move until it's released. Completely drop forged, then heat treated for even more strength and durability, the millions of Lebus Loadbinders now in use prove their ability to tie down loads of every description!

You get an idea of this boomer's strength from the photo above. Two big truckers throw their combined weight on a long cheater without fear of breaking or bending any part —they know that, from handle to hooks, Lebus is the strongest manufactured.

Equally important is the convenience and safety of operation. Once the boomer is locked in position, it can't snap open. Even shifting loads won't spread the handle! Exclusive ball and socket swivel is drop forged—won't pull apart regardless of the load! Get complete details on the number one boomer from your Crosby Laughlin Lebus Distributor!

CAPACITY IN SIGHT



Safety factors on every job are substantially increased by equipping cranes with genuine Crosby* "Load-Rated" Crane Blocks. These rugged blocks carry their rated capacity in plain sight on the side plates. There's no chance for the crew to overload the block by mistaking its capacity. Follow the lead of safety minded companies by specifying Crosby "Load-Rated" Blocks. They're available in a complete range of capacities to 80 tons!

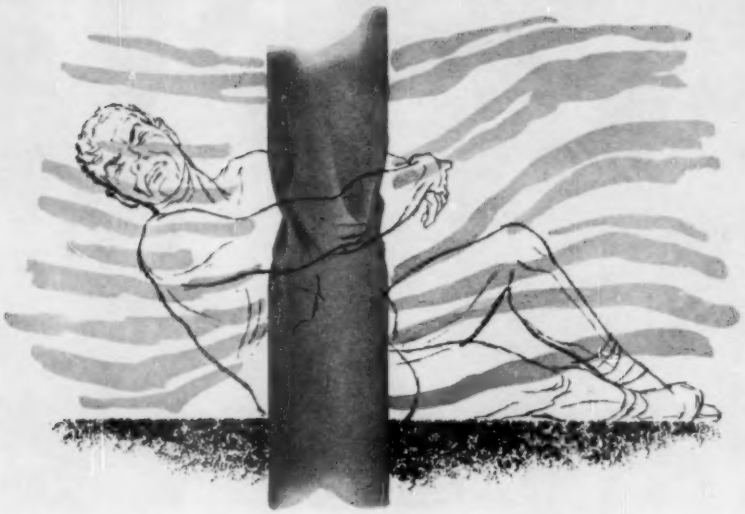
*Registered Trademark.

World's Most Complete Line of Fittings For Wire Rope and Chain

CROSBY LAUGHLIN LEBUS
FORT WAYNE 1, INDIANA

Some water-floods are

STRANGLING themselves!



That's not poetic license, but sober, frightening fact! For the water itself, in many floods, is the very thing that is slowly choking the flood to death. Algae and bacteria (particularly the sulfate-reducing bacteria), not removed by treatment and ordinary filtration, travel into the flood zone with the flood water; there, in the heat and darkness, they thrive and multiply, reducing the permeability almost as effectively as cement. Down goes the drive, up go pump pressures!

THE BRIGHTER SIDE!

But there's a happier story on floods where filtration with Dicalite filteraids is employed. So "sharp" is this filtration that algae and practically all bacteria are effectively removed before the flood water is pumped into the formation. Results? No formation blocking, as proved by the fact that pump pressures remain practically constant, month after month — sustained oil production because the water drive is operating at full efficiency.

LESS COST ... LESS SPACE ... PLUS PORTABILITY

Dicalite filtration of flood water requires less capital outlay and takes less space than do conventional sand filter systems. And, if desired, this more efficient system can be made completely portable, as is the case with several flood systems now operating, which are completely salvageable and movable from one location to another.

Write for complete information.

Dependable GLC GREAT LAKES Dicalite DIATOMACEOUS MATERIALS

DICALITE DIVISION • GREAT LAKES CARBON CORP., 612 SO. FLOWER ST., LOS ANGELES 17, CALIF.

reported a heavy flow of oil from the Wolfcamp section of the Permian.

The test was run between 9,594-9,650 ft., with the tool open 6 hours. Oil surfaced in 28 minutes, then flowed 220 bbl. of 40° oil during the remainder of the test. Flowing pressure was not reported. Gas-oil ratio was 1,025:1. Recovery in the pipe was 100 bbl. of oil.

Location of the strike is slightly more than 2 miles northeast of Texel field, which has production in the Pennsylvanian, Ellenburger and Devonian.

MICHIGAN

Squaw Bay Traverse Wildcat Flows Oil

A Squaw Bay Traverse wildcat oil well in Saint Charles Township, Saginaw County, logged a pay that flowed 90 bbl. of clean oil natural first 24 hours it was on test.

This new strike, Frank E. Roush and J. C. Voorhees 1 Mahoney, NE NE NE 34-10n-3e, logged Traverse oil pay at 2,313½-14 ft. after top of objective was picked at 2,308 ft. Well is presently being tested from an open, uncased, untubed 7-in. hole. It has been flowing by heads, once every 45 minutes since March 12, just 6½ hours after pay was tapped. Well flowed 26 bbl. first 3 hours, 8 bbl. next 4 hours and a total of 90 bbl. by the end of the first 24 hours.

While the Squaw Bay Traverse has shown flashy oil production at several wells in Michigan, development has been restricted due to its erratic production and a spotty development. This well, on the basis of these early tests, appears to be one of strongest wells drilled to date in this formation.

The 1 Mahoney is located in the center of a solid 3,700-acre drilling block controlled by Roush and Voorhees. Structurally, well appears to indicate a flatening in this area which appeared as a nosing on many geological contour maps prior to time wildcat drilled oil pay. This strong flow might indicate effective structural closure in the area.

Successful Wildcats

WEST VIRGINIA

Randolph County, Dry Fork district: Hope Natural Gas Co. 10000 U.S.A. Department of Interior, elevation 3,385 ft., 589,000 cu. ft. gas after second fracture, chert 5,627-5,761 ft., Oriskany sand, 5,844 ft., gas 5,971 and 6,011 ft. TD 6,144 ft.

(Continued on page 321)

THOMPSON *unitized* VACUUM TANKS for *MODERN* Refineries!

More and more refiners, seeking efficient methods, are using Thompson Unitized Vacuum Tanks. For moving liquids and semi-solids, they're first in the field—with no second!

Jobs which used to require hours now take only minutes. One driver-operator cleans tanks, drainboxes, separator boxes, cooling tower basins, spills, and leaks; unplugs drain lines; transfers acids and caustics; oils roads and tank bunds; sprays weeds. No wonder the Thompson UVT is called "the handiest tool!"

A Thompson Unitized Vacuum Tank will be customized to meet your needs. Capacities range from 20 to 100 bbl. Complete units can be skid, truck, semi-trailer or trailer-mounted. Cost is about what you'd expect to pay for a good new car.

If you are searching for tomorrow's way, you'll want to know more about the modern refinery's handiest tool.

Write today for complete specifications.

This is a 45-bbl. Thompson Unitized Vacuum Tank mounted on a GMC truck. This complete, mobile unit, operated by one man provides speed and economy for a host of liquid and semi-solid handling jobs at the world's most modern refinery.

New Model WT50 now available. A complete unit than can be truck-mounted in your own shop. Write for specifications.

THOMPSON
TANK and MANUFACTURING CO. Inc.
2019 EAST WARDLOW RD. LONG BEACH 7, CALIFORNIA

SOLE LICENSEE TO MANUFACTURE VACUUM TANKS UNDER U.S. PATENT NO. 2522077

NEW VAPOR EQUIVALENT APPARATUS

ACCURATE, QUICK VAPOR APPARATUS OF LP RESIDUES AND OTHER LIQUID ORGANIC SAMPLES

A new instrument which measures volume of vapor produced by a unit volume of liquid. Also determines molecular weights by an adaptation of the Victor Meyer method. Vapor equivalent determinations can be made of residues from natural gas samples, or of any liquid with a vapor pressure of more than 4mm. at the temperature of the vaporization bulb. Unit is compact, mounted within a glass constant temperature bath. Unit consists of a vaporization bulb with an integral multiplying manometer and a removable sample entry system consisting of an orifice and matching pycnometer. Bath is equipped with an electric heater.

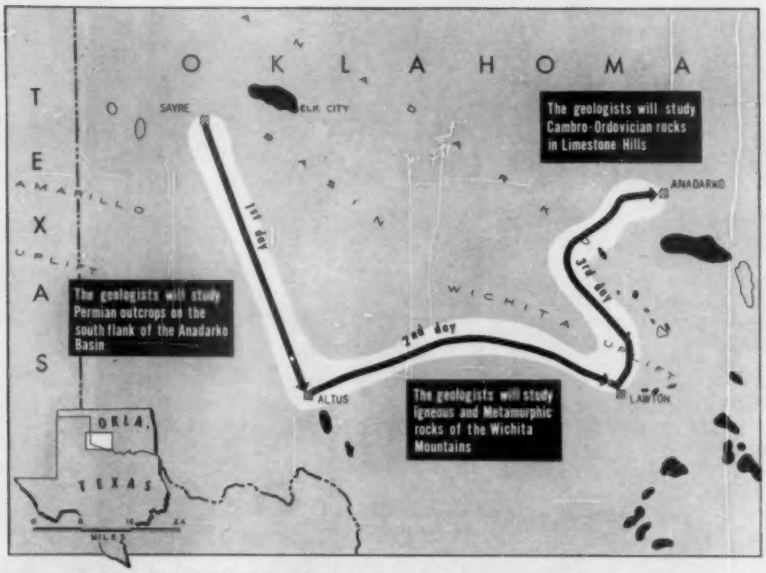
cenco

The most complete line of scientific instruments and laboratory supplies in the world

RS

REFINERY SUPPLY COMPANY
621 EAST FOURTH STREET • TULSA 3, OKLAHOMA
2215 McKINNEY AVENUE • HOUSTON 3, TEXAS

CENTRAL SCIENTIFIC COMPANY
1700 IRVING PARK ROAD • CHICAGO 13, ILLINOIS
CHICAGO NEWARK BOSTON WASHINGTON DETROIT SAN FRANCISCO
SANTA CLARA LOS ANGELES TORONTO MONTREAL VANCOUVER OTTAWA



SOUTHWESTERN OKLAHOMA geological formations will be studied as...

P.G.S. Plans Oklahoma Field Trip

. . . Tour starts at Sayre, May 2

THE Panhandle Geological Society of Amarillo announces a field trip May 2-4 in southwestern Oklahoma, conducted jointly with the Oklahoma Geological Survey and the School of Geology at the University of Oklahoma.

Starting from Sayre in Beckham County at noon Thursday, May 2, the party will study Permian outcrops on the south flank of Anadarko basin, pre-Cambrian igneous and metamorphic rocks of the Wichita Mountains, and Cambrian-Ordovician rocks in the limestone hills north of the Wichita Mountains. The trip ends at noon Saturday, May 4, on outcrops of the Cloud Chief formation 10 miles west of Anadarko.

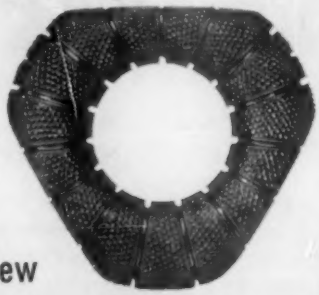
Leaders of the trip and the rocks they will discuss are: Dr. William E. Ham, Oklahoma Geological Survey, Permian and Ordovician rocks; Dr. Clifford A. Merritt, University of Oklahoma and the Oklahoma Geological Survey, pre-Cambrian rocks; and Dr. E. A. Frederickson, University of Oklahoma, Cambrian rocks.

The illustrated guidebook on regional and local geology will include description of oil fields in the region of the field trip, prepared by Dr. Louise Jordan of the Oklahoma Geological Survey.

Registration will begin at 9 a.m. May 2 at the American Legion Hall in Sayre. Reservations should be made by April 26. All reservations must be accompanied by a deposit of $10, which includes the registration fee and guidebook. Student fee is $7.50. Reservations and inquiries should be mailed to Reservations Committee, Panhandle Geological Society, Box 2473, Amarillo, Tex.

"No, this isn't the county asylum for the insane—but, Lady, you came close."

announcing...



the all-new

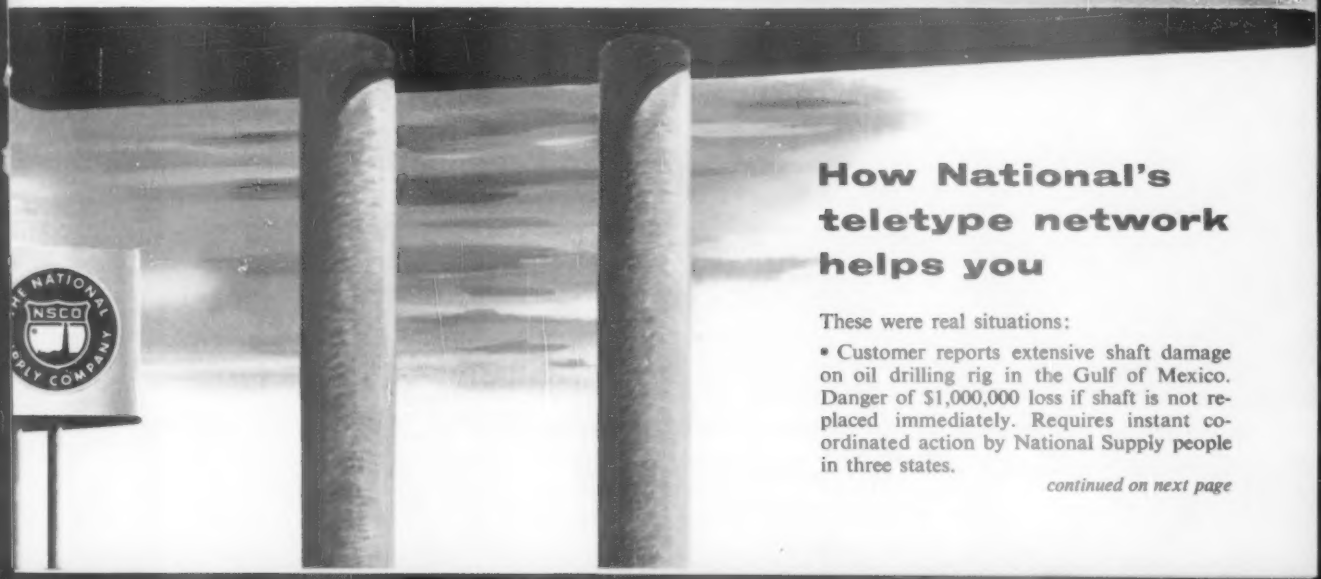
D&S TRI-DIA Core Bit!

Check these outstanding features:

- Designed for safety.
- Reduced OD wall contact, similar to Tri-Cone Rock Bit.
- Reduces mud wall cake sticking hazard.
- When making trip, eliminates swabbing—hydraulic action.
- Minimizes junk iron hazard—allows washing out large pieces.
- Readily washes out cavings to bottom.
- Largest measurable diameter materially less than diameter of hole it will cut. (Special Bit Breaker required.)

WRITE OR CALL TODAY! One of the D & S sales engineers will call on you to show tremendous TRI-DIA Bit and Core Barrel advantages.

Drilling & Service INC. | DIAMOND DRILLING EQUIPMENT
6210 NORTH CENTRAL EXPRESSWAY | DALLAS, TEXAS
OFFICES IN ALL PRINCIPAL OIL AREAS



How National's teletype network helps you

These were real situations:

• Customer reports extensive shaft damage on oil drilling rig in the Gulf of Mexico. Danger of $1,000,000 loss if shaft is not replaced immediately. Requires instant coordinated action by National Supply people in three states.

continued on next page

• Customer requires second hand oil drilling rig. Good chance for sale if one of our offices can locate the right model rig somewhere in the U. S. immediately.

• Fire at oil drilling site. Big machinery damaged. Spare parts must be obtained from warehouses in Texas and Louisiana and plant in California. Must have estimate of damage, repair costs and delivery date today.

National Supply was able to handle these emergencies in time. We were ready for them—just as we're ready for any emergencies you may have. This far-flung company is one of the country's largest users of teletype facilities. Equipment at 103 locations links all our plants with field and headquarter offices. In certain areas we have two-way radio between the headquarters, stores and our field men's automobiles.

It takes good communications to do business with the oil fields, where emergencies are big and demand fast action. They must be especially good when six plants, 129 stores, 68 branch offices and 700 field men are involved. Good communications have been essential in making National Supply the world's largest manufacturer and distributor of oil field machinery and supplies. Good communication—plus the most complete line of quality equipment available. Next time you're facing an emergency, one phone call to National can put all these benefits to work for you.

At Pittsburgh, heart of our 103-station teletype network, this punched tape speeds information to the oil fields.

Get trouble-free production with safe, flexible National hook-ups

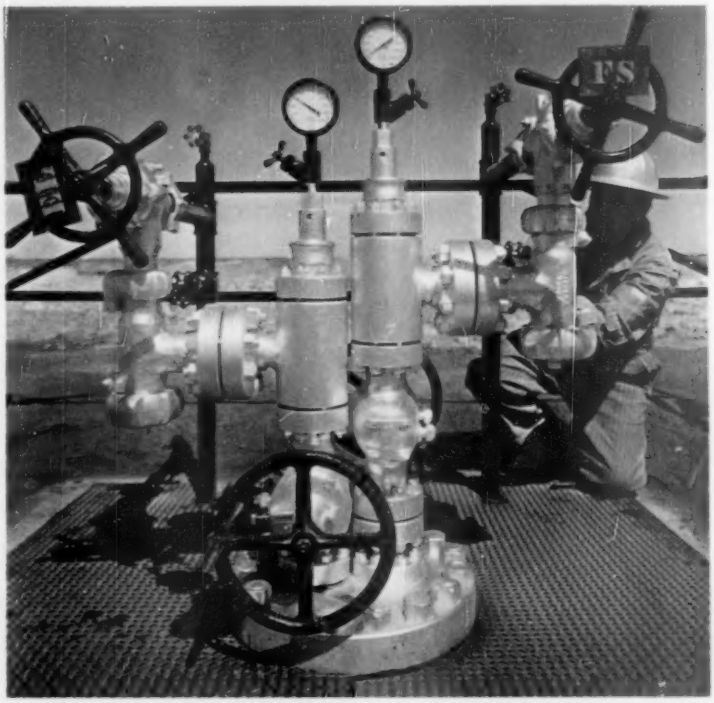
You can check a National Wellhead assembly from the bonnet to the casing flange, and find all the features you need for safe, sure operation. Look at these outstanding features of National Wellhead Equipment—

Ease of assembly—parts are self-locating and self-activating, no special tools are needed for installation.

Maximum flexibility—interchangeable units afford a multitude of combinations to meet your specific needs in size, capacity and type.

Pre-tested safety—National's triple-sealed Pressure Pack design insures trouble-free performance and longer service life. Intensive testing procedures include special methods more severe than those specified by API standards.

You find National Wellhead Equipment readily available through all National Supply Stores—as well as complete advisory service on wellhead application problems. A complete line in every store's stock includes a wide variety of tubing hangers, bonnets, flanged and screwed fittings, valves, flow beans and specialty items to meet your every need. It will pay you to use this quality wellhead equipment and the helpful service that comes with it.

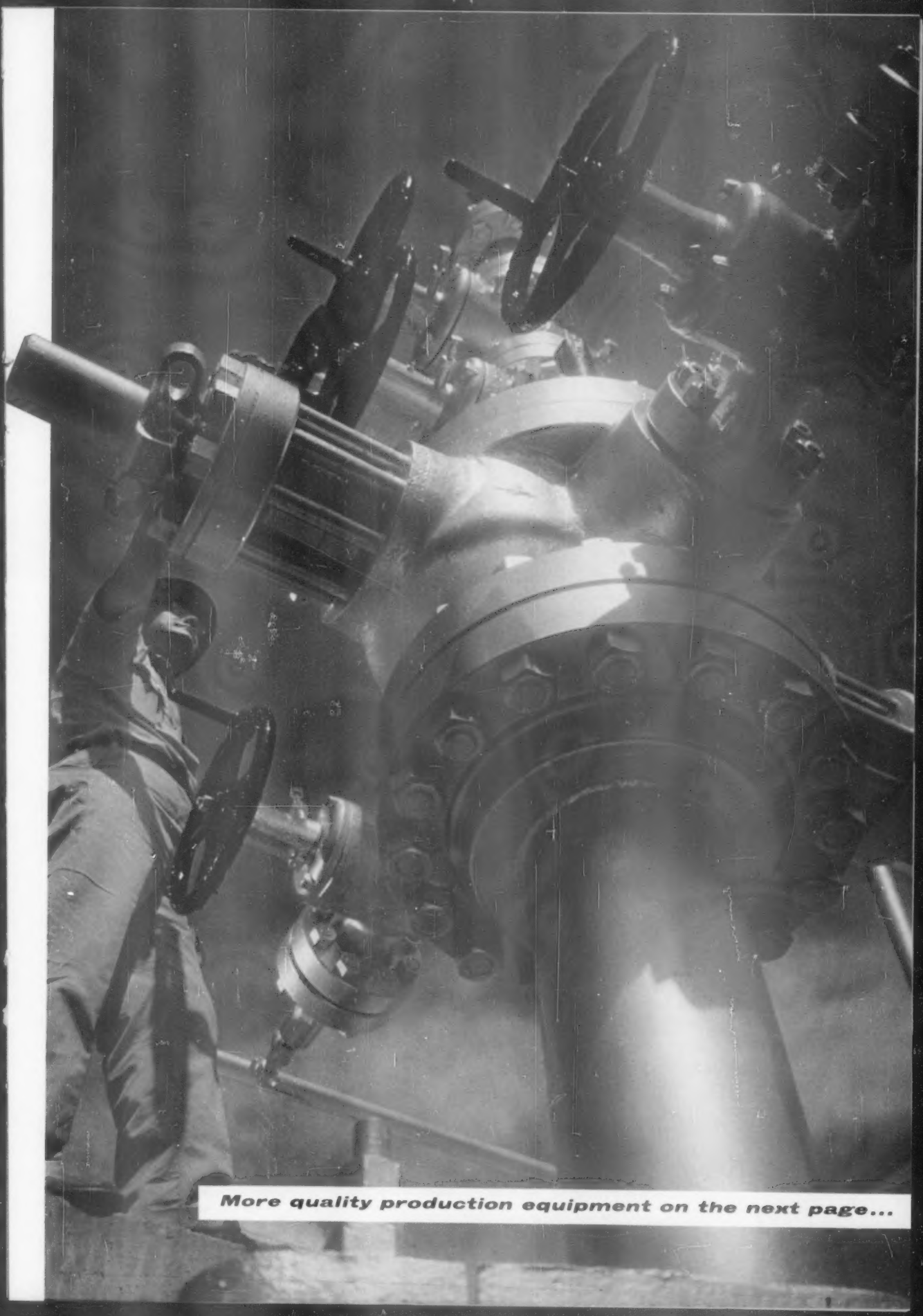


Dual-completion wellhead assemblies like this National installation are very economical under the proper conditions. This operates two strings of tubing, and has two master valves to allow maintenance on one without stopping production on the other.

THE **NATIONAL SUPPLY** COMPANY

MAIN OFFICE: Two Gateway Center, Pittsburgh 22, Pa.
DIVISION OFFICES: Denver; Fort Worth; Houston; Toledo; Tulsa; Torrance
CANADA: The National Supply Company, Ltd., 200 F. W. Clark Building, 709 Eighth Avenue, West, Calgary, Alberta
EXPORT: 600 Fifth Avenue, New York 20, N.Y., U.S.A.; City Wall House, Chiswell Street, London E. C. 1

NATIONAL BLUE OIL FIELD MACHINERY AND EQUIPMENT
SPANG STEEL PIPE AND ELECTRICAL CONDUIT



More quality production equipment on the next page...

Get low cost reliable

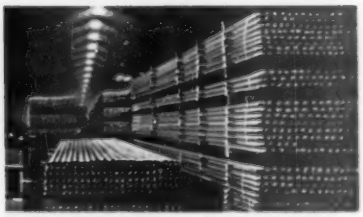
pumping with National units

Having trouble with load reversals? National Pumping Units have an extra margin of strength that meets this problem. They have exceptionally hard alloy steel gears and pinions designed for long wearing life. Gear train mounting and main bearings offer lower shaft loading and deflection . . . easily handle shock loads from load reversals.

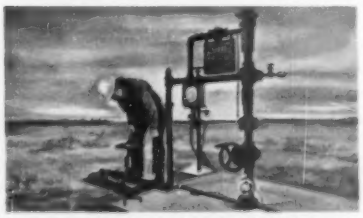
There are other important National Pumping Unit features that insure dependable operation:

- Easy-to-install, strong main base.
- Exceptionally stable, well balanced samson post.
- Pitman assembly features easy maintenance, fast assembly.
- Rugged walking beam and beam hanger for extra years of service.

Get the facts on National Pumpers today. For the full story on the high performance and low operating costs they offer, see the National Supply Store men or representatives in your area soon. New bulletins giving the complete story on these quality pumping units are available.



Get reliable service, too, from precision-made National Sucker Rods. They have top resistance to fatigue, shock, corrosion and impulse loads. Available in a range of grades for every condition.



For certain types of wells, the National Plunger Lift can be the best production method. It uses either formation gas or injected gas for operation. See your National representative for details.

Remember National Triplex Pumps for waterflooding and a host of other oil field pumping jobs. They're available in several h.p. ratings for both corrosion and non-corrosive service.

THE NATIONAL SUPPLY COMPANY

MAIN OFFICE: Two Gateway Center, Pittsburgh 22, Pa.
DIVISION OFFICES: Denver; Fort Worth; Houston; Toledo; Tulsa; Torrance
CANADA: The National Supply Company, Ltd., 200 F. W. Clark Building, 709 Eighth Avenue, West, Calgary, Alberta
EXPORT: 600 Fifth Avenue, New York 20, N.Y., U.S.A.; City Wall House, Chiswell Street, London E. C. 1

NATIONAL BLUE OIL FIELD MACHINERY AND EQUIPMENT
SPANG STEEL PIPE AND ELECTRICAL CONDUIT

(Continued from page 314)

WEST CENTRAL TEXAS

Jones County: Drill Well Oil Co. et al 1 Floyd, R. Davidson Sur. 1, 4 mi. S Avoca. IPP 240 BOPD, 40°, GOR 500, King sand 2,179 ft. TD 2,198 ft.

WEST TEXAS

Coke County: B. B. Smith, Inc., 1 L. E. Smith, S. A. Maverick Sur. 959, 8 mi. W Bronte. IP 78 BOPD, 16/64-in., TP 90 psi., GOR 252, 42°, pay 3,649-51 ft. TD 3,651 ft.

Runnels County: Barmellow Oil Corp. 1 Cora Byars, J. K. Thompson Sur., A-1278. IPP 44 BOPD, 43°, GOR 236, Upper Capps perforations 3,504-08 ft. TD 3,881 ft.

NORTH TEXAS

Clay County: Bobby M. Burns 1-A Mayfield, J. T. Collingsworth Sur., A-96, 6½ mi. W Bellevue. IP 201 BOPD, 8/64-in., GOR 190, 44°, Mississippian 6,038-45 ft. TD 6,051 ft.

Cooke County: Kay Kimbell & Virgill Taylor 1 Miller, J. T. McCucheson Sur., A-1416, 2½ mi. S Callisburg. IPP 78 BOPD, 27°, GOR 100, pay 3,722 ft. TD 4,025 ft.

Grayson County: Nortex Oil & Gas Corp. 2-A Reast, E. L. Stickney Sur., A-1089, ½ mi. S. Sandusky, new pay in West Sandusky field. IPP 74 BOPD, 28°, GOR 300, pay 6,270 ft. TD 6,550 ft. Requested name, Sandusky, W (6,200 ft.).

Knox County: Ted A. Norwood 1-A Melton, 28-2-D&W Sur., 4 mi. NE Munday. IP 151 BOPD, 20/64-in., TP 80 psi., 46°, GOR zero, Tannehill sand 1,930 ft. TD 1,940 ft.

Noel Pautsky 2-P Hune estate, Blk. 23, J. Garner Sur., 5½ mi. SE Bomarton. IPP 21 BOPD, 35°, GOR 500, Tannehill sand 1,511 ft. TD 1,515 ft.

Young County: Bobby M. Burns 1-A Hightower, TE&L Sur., A-437, 4 mi. W Olney. IP 160 BOPD, 8/64-in., TP 825 psi., GOR 602, perforated 5,118-26 ft. TD 5,146 ft.

SOUTH LOUISIANA

Ascension Parish: Gulf Oil Corp. 1 Falcon et al Unit, 21-10s-2e, 1 mile northeast of production. IP 3,000 M.c.f. of gas per day and dist. spray, 12/64-in. choke, 49.6°, perfs. 10,554-88 ft. TD 10,700 ft. New pay and extension well at Darrow.

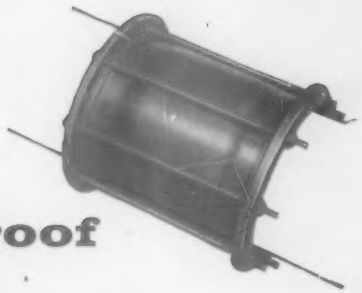
Cameron Parish: Natural Gas & Oil Corp. and Magnolia Petroleum Co. and Ocean Drilling & Exploration Co., Inc., 1 St. Lse. 1172, offshore. IP 3,100 M.c.f. of gas per day and 36 BCPD, 10/64-in. choke, perfs. 12,902-20 ft., 46.3°; 3,150 M.c.f. of gas per day and 32 BCPD, 10/64-in. choke, GPR 100,000:1., perfs. 13,056-13,120 ft., 44.6°. TD 13,440 ft. Dual gas well in East Cameron Block 9.

Terrebonne Parish: The Texas Co. 1A St. Lse. 2986, Block 11. IPF 292 BOPD, 27.6°, GPR 1193:1., perfs. 14,670-14,700 ft. TD 16,290 ft. Extension and new pay at Caillou Island.

Vermilion Parish: Continental Oil Co. 1-A OCS 0169 (St. Lse. 1372); offshore. IP 1,270 M.c.f. of dry gas per day, ¼-in. choke, perfs. 3,570-74 ft. TD 14,005 ft. Gas well.

PENNSYLVANIA

Indiana County, Armstrong Township: T. W. Phillips Gas & Oil Co. 4 G. W. Uncather, elevation 1,213 ft., 1,619,000 cu. ft. gas after fracture, Ondaga 7,348 ft., chert 7,363 ft., Oriskany sand 7,565-85 ft. TD 7,600 ft.



for vibration-proof connections join pipe

THE DRESSER WAY!

Dresser Couplings or Long Sleeves provide the necessary "give and take" to absorb vibration, settlement and other stresses. They're the handiest, surest, safest way of making perfect joints wherever you're joining pipe.

Specially compounded rubber gaskets permit up to 4° deflection at joints—yet with Dresser Couplings these joints stay permanently tight.

Any workman can install Dresser Couplings, averaging only two man-minutes per bolt. The only tool needed is a wrench. Pipe threading is not necessary.

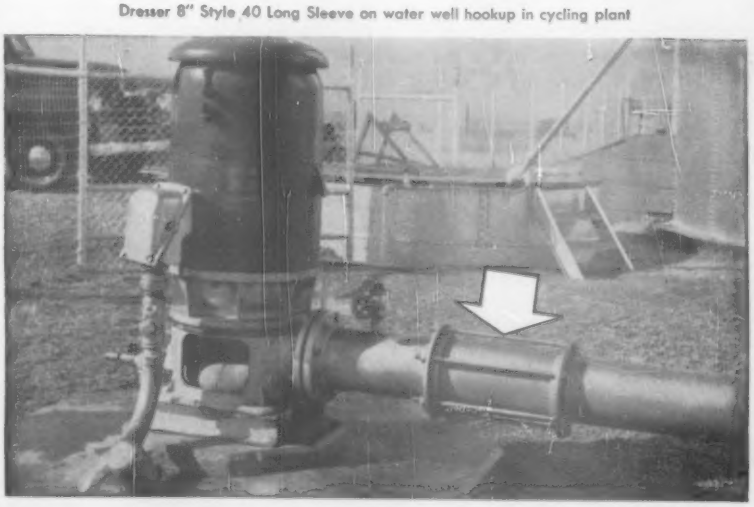
AVAILABLE AT ALL LEADING OILFIELD SUPPLY STORES IN THE UNITED STATES AND CANADA

DRESSER®

Dresser Manufacturing Division • Bradford, Pa.

ONE OF THE DRESSER INDUSTRIES

Dresser 8" Style 40 Long Sleeve on water well hookup in cycling plant



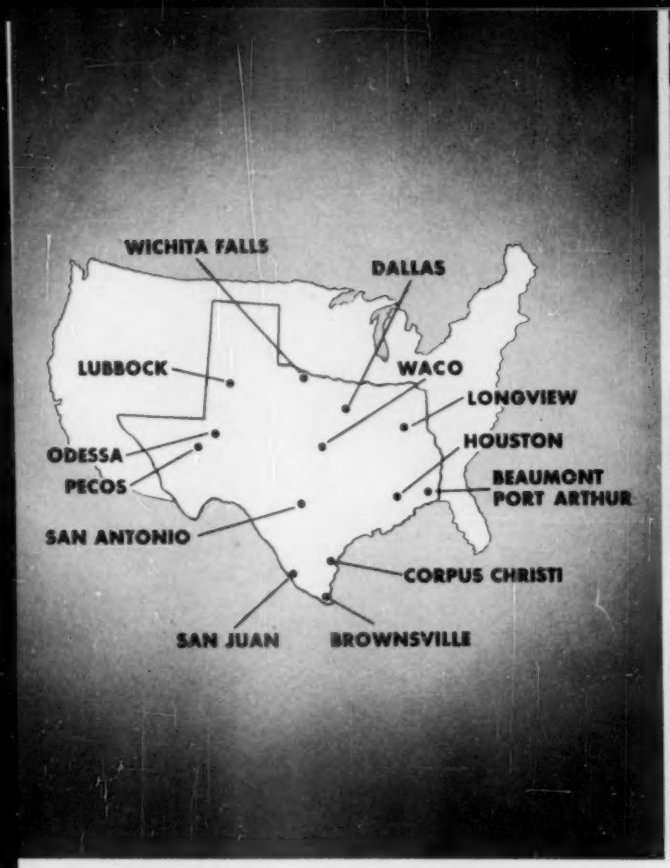
Style 38 Coupling

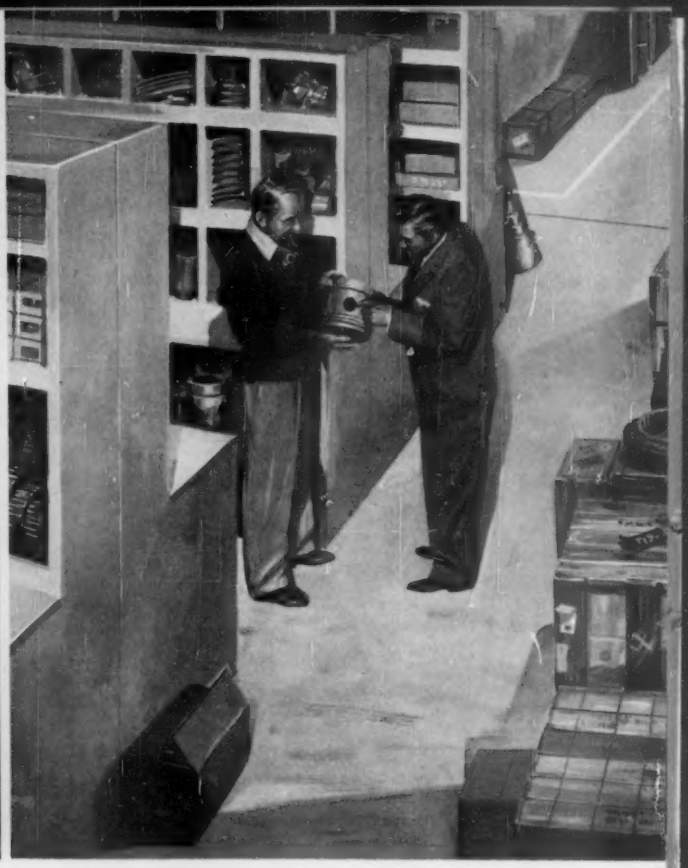
Style 40 Long Sleeve

Hydrepair® Asbestos Cement Pipe Clamp

Style 63 Expansion Joint

Style 39 Insulating Coupling





CONVENIENT LOCATIONS

Regardless of where you are you are only a short time from one of the eight well-equipped Stewart & Stevenson parts and service depots. These convenient locations make really fast service possible.

REPLACEMENT PARTS

Stewart & Stevenson maintains the largest distributor stocks of engine parts to be found anywhere. This insures prompt parts replacement with a minimum of costly downtime.

WHAT DOES IT TAKE to give good

Even the finest engines . . . regardless of where or how you buy them . . . will eventually require service. And your engines cannot perform their job unless serviced promptly and properly. It's as true as the fact that day follows night: NO ENGINE CAN BE ANY BETTER THAN THE PARTS AND SERVICE ORGANIZATION BEHIND IT.

Stewart & Stevenson Services feels a true and continuing responsibility to the thousands of engine customers who have put their full confidence in our organization. To justify this trust, we have built one of the largest (and finest) parts and service organizations in the world. Outstanding service is just one of the reasons why more and more engine users are turning all their power problems over to Stewart & Stevenson Services.

It's easy for everyone to **talk** service, but it takes adequate parts stocks, application skills, service branches, experienced men and industry-wide know-how to **give** the kind of service you expect and need. Stewart & Stevenson Services measures up on every score!

MOBILE PARTS AND SERVICE UNIT

For remote locations there is a fully equipped Stewart & Stevenson Mobile Parts and Service Warehouse which can be moved directly to your location when prolonged service responsibility exists.

SERVICE ANYWHERE — ANYTIME

Stewart & Stevenson Service is as near as your telephone anytime of the day or night. There are multiple listings so you can always get quick service when you need it from competent and well-trained service men.

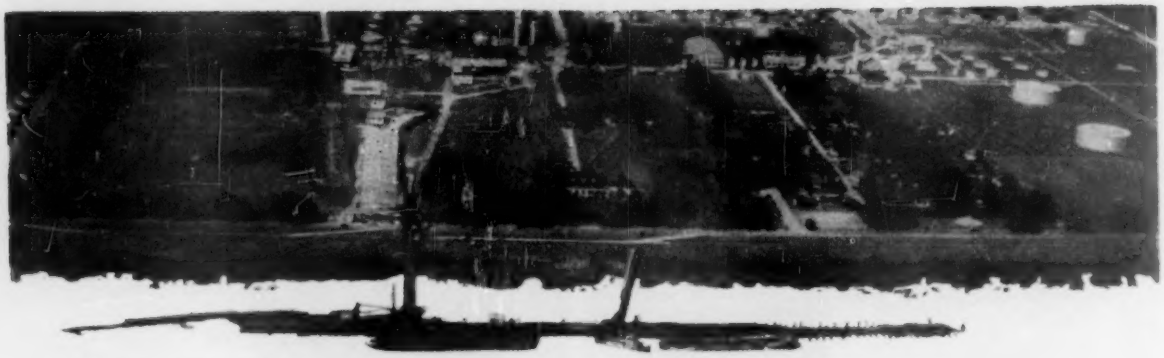
service?

STEWART & STEVENSON

STEWART & STEVENSON SERVICES, Inc.

Main Office and Plant:	4516 Harrisburg Blvd., Houston 11, Texas. Phone CApitol 5-5341
Branches:	Corpus Christi, Dallas, Lubbock, San Juan, Odessa.
Representatives:	San Antonio, Longview, Brownsville, Tyler, Pecos.
Distributors of:	General Motors Diesel Engines, Chrysler Industrial and Marine Engines, Petter Diesel Engines.
Manufacturers of:	Electric Power Units, Electrical Control Equipment, Portable Pumping Units, Red Head Pumps.
Export Office:	Room 1405, 74 Trinity Place, New York, N. Y.

THE NATION'S LARGEST DISTRIBUTORS OF GM DIESEL ENGINES



W. HORACE WILLIAMS CO., INC. DOES IT AGAIN!

An oil company suffered the loss by fire of 630 feet of loading wharf. It was discovered that the lower portions of piles were still sound. A unique design of steel frames, supported by sound portion of piles, was employed. A concrete deck was poured over the steel frames. This resulted in a considerable saving and at the same time gave the resultant structure a fire-resisting construction. W. Horace Williams Co., Inc. engineering skill and know how saved this company considerable money!

Scene at left shows the river with the reconstructed fire-damaged portion of wharf. Notice the steel frames above old piles and the concrete deck.

W. HORACE WILLIAMS COMPANY

ENGINEERS INCORPORATED GENERAL CONTRACTORS

833 Howard Ave. **Ph. RAymond 1291**

Marine Contractors Since 1908

NEW ORLEANS

OFFSHORE STRUCTURES, WHARVES, BULKHEADS, FOUNDATIONS

JOHN P. HAMMOND

Hammond is first president as . . .

. . . Old Society Gets New Format

AN organization which put down its roots with the drill which tapped famed old Spindletop field got its first president this month.

The new leader is John P. Hammond, Tulsa, assistant general superintendent of production for Amerada Petroleum Corp. He is president of the Society of Petroleum Engineers of the American Institute of Mining, Metallurgical, and Petroleum Engineers.

While the society is not new, its name is. And so is much of the prestige which accompanied the name change. The move was the culmination of a long series of steps dating back to the early years of the century.

The steps moved the petroleum segment up the ladder from a committee to a division to a branch and finally to a society which has equal footing with the other two societies of A.I.M.E.

Petroleum's seeds were planted in A.I.M.E. by Capt. Anthony F. Lucas, the Australian mining engineer who turned to oil and brought in Spindletop in 1901. This success led so many other engineers of the organization into the oil industry that a committee on petroleum was formed in 1913 with Lucas as chairman.

First president . . . Hammond joined the organization in 1937 and has held several top posts. In 1949, he was chairman of the Mid-Continent Local Section of A.I.M.E. He was later vice chairman of the Petroleum Branch.

But what he considers one of his most important jobs was as chairman of the publications committee, now the transactions editorial committee. The committee reviews technical papers—and makes final rulings on them—for publication in the important Journal of Petroleum Technology, published by the engineering society.

Hammond's new job puts him in a good position to take over some day as president of the A.I.M.E. since presidency of the institute is rotated between the three member societies.

Hammond was born in Okmulgee, Okla. He received his high school training in Tulsa and his petroleum engineering degree at the University of Tulsa. One of his professors was Kenneth B. Barnes, now editor of The Oil and Gas Journal.

During undergraduate days, Hammond made summertime tours of Mid-Continent oil fields as a roustabout. His first job after graduation was with his father, John W. Hammond, an independent oil operator who owned half a dozen companies at various times.

Independent operator . . . On this job, Hammond got some well-rounded field experience in the art of finding and producing oil. He performed just about all the jobs there are in connection with these activities.

Hammond later joined Mid-Union Drilling Co. of Tulsa where he continued his jack-of-all-trades activities. Working throughout Texas, he was everything from pumper to tool pusher.

Hammond joined Amerada as petroleum engineer in 1941 at Paradis, La., near New Orleans. Late in 1943, he moved to Tulsa as assistant to C. V. Millikan, the company's chief engineer who won the Anthony F. Lucas Gold Medal award for distinguished achievement in 1944.

In 1949, Hammond became assistant to the vice president in charge of production and 2 years later was moved up to his present job as assistant general superintendent.

Remembering his days as an independent with his father, the days when his own money went down a lot of dry holes, Hammond winces at the widespread idea that oil is a wide, straight, and smooth avenue to riches. Not so, he declares emphatically. And he points out that a lot of men who went broke along that road will testify to that fact.

One of the most important functions of the Society of Petroleum Engineers is to encourage the nation's youth to obtain engineering degrees and go to work in the oil industry. That must be frustrating to the man who has the honor of being the group's first president. Here's why:

You might say the Hammond heritage is steeped in oil. Hammond is an oil man. His father was an oil man. His father-in-law was an early-day geologist in the Tulsa area and a geology professor at old Henry Kendall College, now the University of Tulsa.

And Hammond is the father of three children. But chances are about as thin as a 50-cent steak that there is a petroleum-engineer candidate in the lot. They're all girls.

George F. Getty II, vice president and a director of Tidewater Oil Co. and general manager of its eastern division, has been elected a director of Mission Development Co.

Phillip Risch is being sent to Sumatra by Standard-Vacuum Oil Co. as district mechanical supervisor for the production department at Talang Akar. He formerly was sales engineer in Tulsa for Byron Jackson Pumps, Inc.

William D. Elliott, assistant manager of Leonard Crude Oil Co.'s crude-oil department, has been promoted to manager of crude-oil purchases and sales. He succeeds **David W. Dolson,** now manager of crude-oil and products supply for Leonard Refineries, Inc.

B. W. Dunbar, department manager, Zone B, in Shell Oil Co.'s Anacortes, Wash., refinery, has been appointed chief technologist. He succeeds **C. A. Rehbein,** recently appointed special technologist in manufacturing, head office. **W. A. Mitchell,** assistant department manager, Zone B, has moved up to manager replacing Dunbar. **J. A. Hatton,** senior technologist in the refinery's manufacturing department, has been named assistant chief technologist.

Personals

M. W. SWANEY

Dr. Miller W. Swaney, director of Esso Research & Engineering Co.'s products research division, has been named coordinator of chemicals and lube-oil processes. He succeeds **Harold J. Rose,** recently named assistant general manager of Esso Standard Oil Co.'s chemical-products department. Swaney joined Esso in 1939. He was director of Enjay laboratories before becoming director of products research. **Dr. Neil V. Hakala,** associate director of products research, has moved up to succeed Swaney as director. Hakala has been with the company since 1943 and has been associate director since last year. **Dr. Leonard E. Moody,** assistant director in the products research division, has been named associate director replacing Hakala. **Ben W. Geddes,** head of aviation and diesel-fuels section in products research, has been appointed assistant director succeeding Moody.

C. W. Allen has resigned as a geologist for Spartan Drilling Co., Dallas, to join the geological staff of Midwest Oil Corp. in Fort Worth.

David R. Keck, engineering consultant with Celanese Corp. of America, has joined Hudson Engineering Corp. in Houston as project engineer.

Jack E. Hughes has joined Drilling & Exploration Co. as a geologist with headquarters in Dallas. Hughes was previously with Atlantic Refining Co. and D. D. Feldman Oil & Gas.

James G. Heid, petroleum engineer with Monterey Oil Co. in Long Beach, Calif., has resigned to join Parker Petroleum Co., Inc., as petroleum engineer in Ponca City, Okla. Heid had been with Monterey since 1953. Before that time he was reservoir engineer and petroleum engineer with Continental Oil Co.

Levi Shiplet, The Texas Co., and **C. R. Athy,** Maxwell Steel Co., both of Fort Worth, and **M. R. Hayes,** Phillips Petroleum Co., and **J. W. Hall,** Durham Drilling Co., both of Midland, have received citations for service from the American Petroleum Institute. The national awards were presented at the A.P.I.'s southwestern production district meeting in Dallas.

Bryant W. Bradley, mechanical engineer with Shell Oil Co., has been transferred to Ventura, Calif., from New York.

Stanley G. Cohen, petroleum engineer trainee with Midstates Oil Corp., has been transferred to Seminole, Okla., from Odessa, Tex.

Warren R. Oates, formerly with Cabeen Associates in Denver, has joined Skelly Oil Co. as geologist in Sterling, Colo.

Lawrence E. Barnett, petroleum engineer with The Texas Co., has been transferred to Craig, Colo., from Rangely, Colo.

Dale M. Robinson, district engineer with Atlantic Refining Co., has been promoted to production engineer and transferred to Tulsa from Great Bend, Kans.

T. A. Wooters has been promoted by Delhi-Taylor Oil Corp. from office engineer to manager of crude oil purchases and sales in Corpus Christi, Tex.

J. Ed Warren, vice president of First National City Bank of New York, has been named senior vice president. Warren joined the bank in 1953 as petroleum consultant. He is a past president of Carl B. King Drilling Co., Independent Petroleum Association of America, and the American Association of Oilwell Drilling Contractors. Warren was also deputy administrator of the Petroleum Administration for Defense at one time.

J. R. Carroll, manager of Texas Petroleum Co.'s Venezuelan producing division, Caracas, Venezuela, has been appointed assistant manager of the producing division of The Texas Co.'s foreign operations department (Western Hemisphere and West Africa) with headquarters in Caracas. **R. E. Wright,** senior assistant manager of Texas Petroleum's producing division, has been promoted to manager succeeding Carroll. Also joining Texas Petroleum in Venezuela is **Paul Youngmeyer,** assistant manager of Texaco Exploration Co., Calgary, now assistant manager of exploration in Caracas. **J. M. Patterson,** chief geologist, has been promoted to assistant to the manager of Texas Petroleum. **J. E. F. Caston** will succeed Patterson as chief geologist, and **Harvey Stein** has been named assistant chief geologist. **Raymond D. Holland,** geologist for Texaco Exploration in Calgary, will succeed Youngmeyer there as assistant manager.

L. B. Manley has been appointed executive vice president of Barnwell Drilling Co., Inc., and general manager of Barnwell Production Co. Manley was formerly land man with Barnwell Production.

Don E. Hibbard, geologist with Seaboard Oil Co. in Denver, has been transferred to Dallas as foreign geologist.

Glen J. Gilmore, driller-tool pusher with Riceland Corp., has been transferred to Oklahoma City from Sedan, Okla.

K. C. Thompson, division geophysical supervisor for Pan American Petroleum Corp. in Oklahoma City, has been named geophysical supervisor of foreign operations. He will coordinate geophysical activities for Pan American subsidiaries in the Caribbean area. **J. N. Walstrum,** geophysical supervisor, will succeed Thompson as division geophysical supervisor in Oklahoma City.

M. N. Broughton, staff geologist in The Texas Co.'s domestic producing department, has been named staff geologist in the New York foreign operations department (Western Hemisphere and West Africa). Broughton has been with Texaco since 1933. He was division geologist, South Texas division, before going to New York in 1954 as staff geologist in domestic production.

Claude F. Horton, Houston consultant, has been elected executive vice president and a director of Construcciones Collins de Venezuela and assistant to the president in contract negotiations for Collins Construction Co., Port Lavaca, Tex. A graduate of Massachusetts Institute of Technology, Horton was vice president in charge of pipeline construction for Brown & Root, Inc., until 1955.

Charles M. Forney, district manager for Champlin Oil & Refining Co. in Wichita, has been transferred to Oklahoma City in the same capacity. **H. Marvin Douglass** will succeed Forney in Wichita. **Virgil Tucker** will succeed Douglass as Kansas area geologist. **Gene Williams,** district engineer in Oklahoma City, has been transferred to Fort Worth as special projects engineer, and **Claude J. Scroggins, Jr.,** district engineer, has been transferred to Oklahoma City from Pauls Valley, Okla.

Robert C. Roesch has been transferred by Amerada Petroleum Corp. to Tulsa from Houston as assistant seismic superintendent.

Robert J. Martin, chief chemist with Husky Oil Co. in Cody, Wyo., has joined Western States Refining Co. in Salt Lake City as process engineer.

G. L. WEGER

Gene L. Weger, assistant division production superintendent in Sinclair Oil & Gas Co.'s Denver division, has been promoted to division production superintendent. He replaces **J. A. Jackman,** who recently joined Sinclair Pipe Line Co. **Ford P. Haskin,** production superintendent of Sinclair's Montana and Wyoming districts, has been appointed assistant division production superintendent in Denver succeeding Weger. **Troy C. Kadel,** production superintendent of the Colorado-Nebraska district, has transferred to Casper, Wyo., from Fort Morgan, Colo., to replace Haskin and **Aubrey B. Parker,** district production foreman at Powell, Wyo., succeeds Kadel as Colorado-Nebraska production superintendent in Fort Morgan.

Robert B. LeFever, district superintendent at Lubbock, Tex., for Pan American Petroleum Corp., has been transferred to Calgary as assistant division production superintendent. **Neil S. Whitmore** has been appointed district superintendent replacing LeFever and transferred to Lubbock from Midland, Tex.

Robert A. Kidd, Clyde C. Osborn, and **Gilbert L. Price** have been promoted to senior petroleum engineers with Sinclair Oil & Gas Co. Kidd has been transferred to Tulsa from Drumright, Okla. Osborn will move to Kiefer, Okla., from Thrall, Kans., and Price to Ardmore, Okla., from Lindsay, Okla. **Charles W. Shawn,** assistant district foreman in Carmi, Ill., has been promoted to district foreman and transferred to Stafford, Kans. **Robert R. Quier** has been named assistant district foreman and transferred to Covington, Okla., from Kiefer. In other transfers, **George V. Dunn, Jr.,** senior petroleum engineer at Kiefer, and **John N. Eibeck,** senior petroleum engineer at Ardmore, have been transferred to Tulsa. **Eugene E. Gumm,** district foreman in Stafford, Kans., has been transferred to Velma, Okla., and **Dean B. Towell,** assistant district foreman, has been moved to Carmi, Ill., from Covington, Okla.

Ted L. Bear, consultant, and **Phillip S. Kistler,** formerly principal representative in Brazil and Spain for DeGolyer & MacNaughton, have opened consulting offices in Los Angeles.

Dale R. Hieger, production engineer with Sunray Mid-Continent Oil Co., has been transferred to Pawhuska, Okla., from Lewisville, Ark.

Ted E. Waibel, Jr., junior petroleum engineer with Sinclair Oil & Gas Co., has been transferred to the company's Tulsa division headquarters from Nowata, Okla.

W. G. Sinclair, Jr., petroleum engineer with Gulf Oil Corp. in Fort Worth, has been promoted to reservoir engineer and transferred to Odessa, Tex.

Earl M. Kieke, field engineer with Pan American Petroleum Corp., has been promoted to petroleum engineer, senior grade, and transferred to Angleton, Tex., from Beaumont.

K. N. Bradley has been appointed senior engineer by Service Pipe Line Co. A graduate of Oklahom A. & M. College, Bradley has been with Service Pipe Line since 1947.

Warren Davis, geophysical supervisor with the C.A.T.C. group, has transferred to Continental Oil Co.'s Houston office as assistant exploration manager.

S. B. Kieselhorst, assistant manager of Shell Oil Co.'s crude-oil and volatiles department in headquarters transportation and supply, has been named manager of the department. He succeeds **M. E. Overman,** who has retired.

John Payne, Shell Oil Co., Houston; **S. C. Oliphant,** Tennessee Gas Transmission Co., Houston; **Earle Hellums,** Gracey-Hellums Corp., also of Houston; and **Joseph S. Morris,** Allen & Morris, San Antonio, Tex., have received citations for service from the American Petroleum Institute. The awards were made at the A.P.I.'s Production Division southern district meeting in Shreveport, La., last week.

M. B. Morris, Continental Oil Co.'s assistant southern regional geologist in Houston, has been promoted to assistant manager of the headquarters geological section. He succeeds **B. B. Colley,** recently promoted to regional exploration manager in Oklahoma City. Morris has been with Conoco since 1948. He was division geologist in Houston before becoming assistant regional geologist in 1954.

Personals

Robert E. Stiles has joined Emmett F. Lowry Construction Co., Texas City, Tex., as general manager of the pipeline department.

Dr. Irving D. Webb has been named manager of the chemical-research division of Union Oil Co.'s research department.

J. R. Bowen, senior technologist at the Norco, La., refinery of Shell Oil Co., has been appointed assistant chief technologist there. Bowen has been with Shell since 1944.

Harold S. Winston, petroleum engineer, production, with Gulf Oil Corp., has been named petroleum engineer in the reservoir section and transferred to Odessa, Tex., from Goldsmith, Tex.

L. Wayne Hicks, project inspector at American Oil Co.'s Yorktown, Va., refinery, has been appointed assistant director of the company's general engineering department and transferred to Texas City, Tex. Hicks has been with American Oil since 1948.

DEATHS

Harry Allison Logan, 75, Warren, Pa., president of United Refining Co. and Emblem Oil Co., died March 13 in Warren. Logan was a director of the American Petroleum Institute and Pennsylvania Grade Crude Oil Association and a trustee of National Petroleum Association, which he served as president in 1942. During World War II he was a member of the Petroleum Industry War Council.

Arthur F. Corwin, 80, retired vice president and director of the old Socony-Vacuum Oil Co., died March 13 in New Rochelle, N. Y. Corwin joined Standard Oil Co. of New York, predecessor of Socony-Vacuum and Socony Mobil Oil Co., in 1926. He retired in 1945.

Alfred Flekal, 58, owner and founder of Oilfield Vacuum Service, died March 13 in Bakersfield, Calif. Flekal was a member of the Los Angeles Petroleum Production Pioneers, Inc.

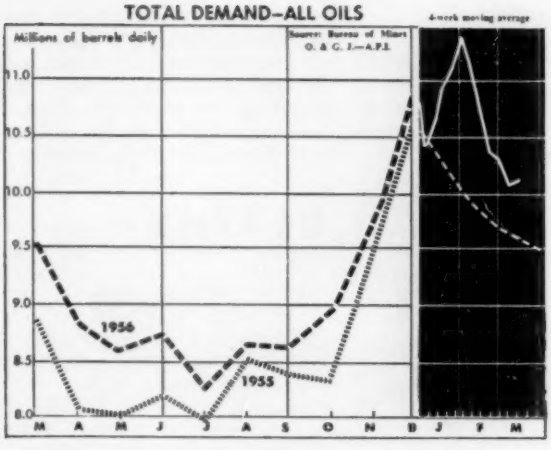
James E. Smith, 72, Houston independent, died March 13 in Austin, Tex.

Stanley A. Odlum, 41, vice president of Atlas Corp., died March 15 in New York after a brief illness.

Latest Figures . . . Industry Trends

A QUICK LOOK AT THE HIGHLIGHTS

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	7,789,875	DOWN	10,600	UP	520,214
Crude stocks	251,993,000	DOWN	1,663,000	DOWN	4,000,000
Completions	1,150	UP	264	UP	72
Refinery runs	8,098,000	UP	22,000	UP	112,000
Gasoline stocks	205,589,000	DOWN	193,000	UP	9,648,000
Kerosine stocks	19,701,000	DOWN	1,010,000	UP	1,742,000
Distillate stocks	79,599,000	DOWN	3,732,000	UP	12,213,000
Residual stocks	36,283,000	DOWN	100,000	UP	1,245,000
Four-product stocks	341,172,000	DOWN	5,035,000	UP	24,848,000
Total imports	1,697,200	UP	379,300	UP	298,000



Shifts in Foreign Buying, Stocks, and Weather Depress Product Markets

. . . SHIFTS in foreign demand for Gulf Coast products are having a depressing effect on product markets in this country.

. . . Warmer-than-normal weather during the heating season left too much distillate in primary storage this year.

. . . Spring gasoline prices will be influenced by the extra 10 million barrels of gasoline added to storage since this time last year.

. . . Better-than-average increases in gasoline demand have not been enough to counteract the market depressors.

In the rush to line up distillate last winter, European buyers contracted for some distillate for delivery through March at about 0.5 cent a gallon over the Gulf Coast low. Since that time the European supply situation has changed. More crude is available for refineries in England and France, including Middle East crude from pipeline terminals in Syria and Lebanon.

With additional Middle East crude available to the European refiner, Gulf Coast distillate is no longer attractive at the low of formal market or 10.25 cents a gallon for No. 2 fuel. The buyers would like to sell the No. 2 back at a discount. During the second week of March it was offered at 0.5 cent under the low. The offer was withdrawn but it left the market jittery.

No. 2 fuel is available on the Gulf Coast at 10.0 cents a gallon. Some marketers report that it could be bought for 9.875 cents, but that buyers are scarce. The low at this time last year was 9.0 cents.

Movement of distillate from Mid-Continent refineries has slowed down since the first of March. No. 2 fuel is available at pipeline terminals at 9.0 cents a gallon, Group 3. At this time last year, the Group 3 low for No. 2 fuel was 9.25 cents. In the meantime, the refiner's crude cost is up at least 25 cents a barrel.

Residual fuel on the Gulf Coast is reasonably steady at $2.75 a barrel. The lack of pressure points to the possibility of a good market for resid throughout the summer. However, the price may have to come down slightly. The cargo market was $2.10 for the first 11 months of 1956.

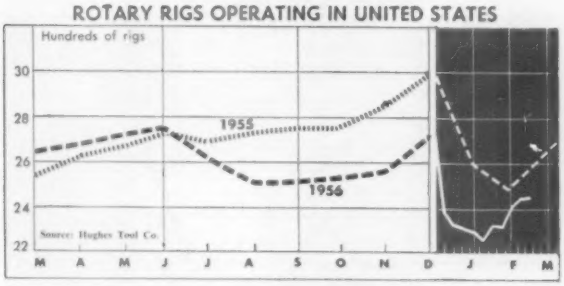
Very little spot residual is moving on the Group 3 market. Unless there is a big switch to production of road oil and asphalt this summer, the price may move back nearer last summer's low of $2.00 a barrel.

Pressure on the gasoline market is due to surplus stocks and not to any lack of demand. Total demand for gasoline for the first 2 months of the year averaged 7 or 8 per cent more than for the same months of 1956. On the other hand, total gasoline stocks show a gain of about 10 million barrels over last year. And, stocks last year were high. Total gasoline stocks at the end of March 1956 represented a gain of 15.7 million barrels over the previous year.

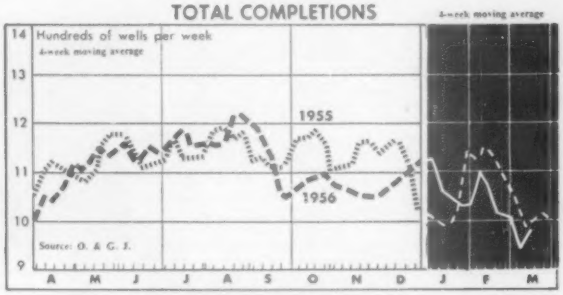
This 2-year increase in gasoline stocks is holding the gasoline market down despite excellent increases in demand. Regular 92-octane gasoline on the Gulf Coast spot market is showing very little activity even at 11.25 cents a gallon. This means the buyer can get regular gasoline at the same price he paid last fall before the crude-price increase.

Group 3 regular is selling for 11.75 cents or 1.0 cent above the December price. However, the Group 3 price was subnormal last fall. The low for regular was 11.75 cents after the octane increase early in the summer, but it dropped to 10.75 cents by the first of December.

ROTARY RIGS OPERATING IN UNITED STATES



TOTAL COMPLETIONS

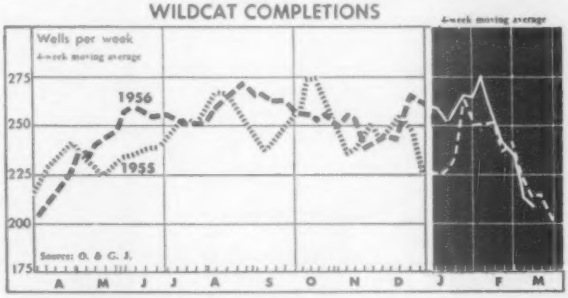


ACTIVE ROTARY RIGS*

Area—	3-18-57	3-11-57	3-19-56
North Central and East	88	82	100
Southeast	35	37	28
Okla., Kans., Ark., Mo.	435	426	513
Louisiana	427	442	429
North and East Texas-Panhandle	425	394	446
Gulf and South Texas	229	234	278
West Texas-New Mexico	514	513	551
Rocky Mountain	200	216	216
Pacific Coast	97	99	125
Total United States	2,450	2,443	2,686
Western Canada	243	250	243

*Hughes Tool Co.

WILDCAT COMPLETIONS

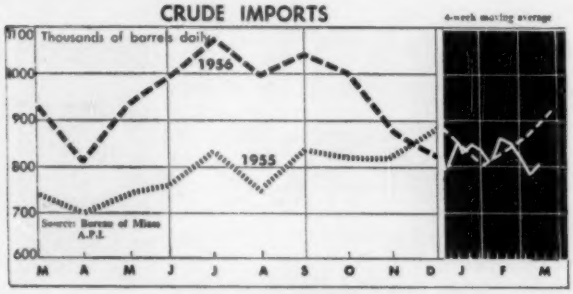


WEEKLY WELL COMPLETIONS . . . WEEK ENDED MARCH 16, 1957

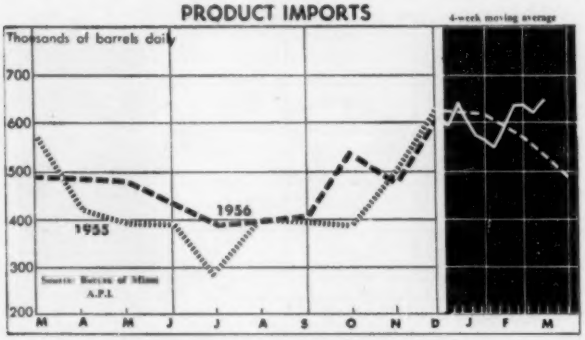
	Total of all wells					Cum.		Wildcat completions and discoveries					Cumulative total, 1957				
	Comp.	Oil	Gas	Dry	Footage	1957	1956	Oil	Dist.	Gas	Dry	Total	Oil	Dist.	Gas	Dry	Total
Ala.-Ga.-Fla.	†1	1	0	0	11,448	15	21	0	0	0	0	0	0	0	0	5	5
Arkansas	21	12	1	8	69,599	227	144	0	0	1	3	4	5	0	1	28	34
California	42	33	0	9	177,500	437	438	1	0	0	7	8	8	0	2	105	115
Colorado	15	2	0	13	86,402	232	244	0	0	0	12	12	7	0	3	146	156
Illinois	40	13	0	27	96,853	502	726	0	0	0	14	14	7	0	1	113	121
Indiana	12	1	0	11	17,757	134	117	0	0	0	4	4	3	0	0	23	26
Kansas	108	55	11	‡42	388,511	909	1,026	3	0	1	9	13	29	0	5	121	155
Kentucky	36	14	4	18	38,221	314	363	0	0	0	8	8	8	0	1	61	70
Louisiana	85	49	7	29	688,973	794	820	1	1	2	5	9	17	7	19	89	132
North	29	15	3	11	100,453	305	304	0	0	0	1	1	2	0	2	32	36
South	37	23	1	13	393,820	352	414	0	1	0	4	5	8	7	13	51	79
Offshore	19	11	3	5	194,700	137	102	1	0	2	0	3	7	0	4	6	17
Michigan	5	0	0	5	13,174	83	108	0	0	0	4	4	3	0	0	33	36
Mississippi	9	3	0	6	58,387	69	95	0	0	0	4	4	4	0	0	29	33
Montana	6	3	0	3	26,802	64	83	0	0	0	1	1	2	0	0	20	22
Nebraska	16	5	0	11	92,400	161	191	0	0	0	9	9	8	0	0	83	91
New Mexico	30	19	4	7	145,004	415	400	0	0	0	4	4	14	1	4	45	64
Northwest	4	1	2	1	17,293	150	143	0	0	0	1	1	6	1	3	14	24
Southeast	26	18	2	6	127,711	265	257	0	0	0	3	3	8	0	1	31	40
North Dakota	6	4	0	2	42,521	71	46	0	0	0	2	2	4	0	0	24	28
Ohio	23	9	4	§10	56,816	214	228	0	0	0	0	0	0	0	0	3	3
Oklahoma	121	78	0	¶43	455,123	1,434	1,859	3	0	0	12	15	27	4	1	134	166
Pennsylvania-New York	*120	54	7	59	150,299	179	150	0	0	1	1	2	0	0	8	14	22
Texas	404	236	18	150	1,739,354	4,609	4,432	9	2	4	82	97	143	9	52	1,088	1,292
Southwest (1 & 4)	40	21	3	16	180,231	519	672	2	0	1	11	14	19	2	15	168	204
Gulf Coast (2 & 3)	43	22	5	16	291,265	561	556	0	2	2	11	15	14	4	28	156	202
East (5 & 6)	20	10	3	7	112,737	264	244	0	0	0	7	7	4	0	1	76	81
N. Central (7-B & 9)	131	76	1	54	384,903	1,678	1,485	5	0	1	27	33	70	0	3	490	563
West (7-C & 8)	151	96	0	55	709,777	1,281	1,232	2	0	0	26	28	34	0	4	178	216
Panhandle (10)	19	11	6	2	60,441	306	243	0	0	0	0	0	2	3	1	20	26
Utah	3	0	0	3	10,360	28	17	0	0	0	3	3	3	0	0	13	16
West Virginia	18	1	16	1	47,302	150	152	0	0	0	0	0	0	0	7	2	9
Wyoming	27	17	0	10	126,343	181	170	1	0	0	6	7	8	0	2	56	66
Miscellaneous (S. D.)	2	0	0	2	4,906	19	46	0	0	0	2	2	0	0	1	12	13
Total U. S.	**1,150**	609	72	469	4,544,055	11,241	11,876	18	3	9	192	**222**	300	21	107	2,247	2,675
Total previous week	886	470	72	344	3,621,452	.....	.....	15	5	7	172	199	282	18	98	2,055	2,453
Total Mar. 17, 1956	1,078	634	84	360	4,453,908	.....	.....	33	3	4	165	205	351	33	79	2,194	2,657
Cumulative 1957	11,241	6,015	815	4,411	46,052,443	.....	.....	...	...	...	...	...	...	...	...	...	...
Western Canada	53	37	0	16	270,903	519	475	0	0	0	15	15	8	0	13	117	138

Service wells included: ‡1, §2, ¶8. *Incl. 111 N. Y. wells (Jan. 1-Mar. 16). †Ala.

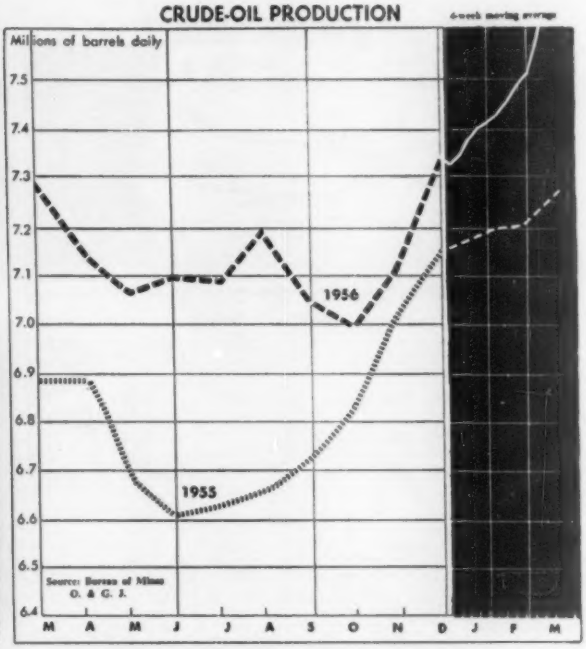
CRUDE IMPORTS



PRODUCT IMPORTS



CRUDE-OIL PRODUCTION

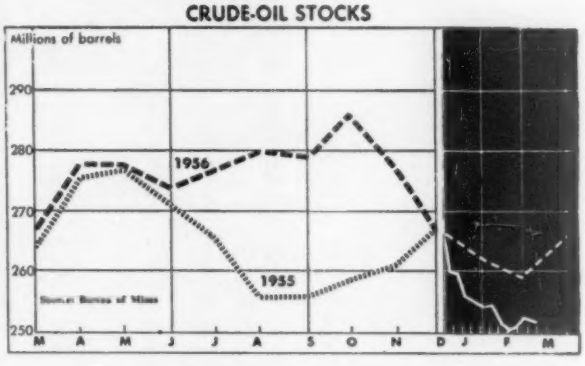


DAILY AVERAGE PRODUCTION FOR WEEK

	March 16, 1957			Mar. 9
	Crude oil	Lease condensate	Total	total
Alabama	11,700	.....	11,700	11,650
Arkansas	83,400	350	83,750	83,600
California	938,400	.....	938,400	939,200
Colorado	158,600	.....	158,600	158,200
Eastern	50,600	.....	50,600	50,900
Florida	1,250	.....	1,250	1,250
Illinois	236,000	.....	236,000	231,800
Indiana	32,500	.....	32,500	33,100
Kansas	†351,900	.....	†351,900	†353,200
Kentucky	50,400	.....	50,400	50,200
Louisiana	939,800	76,350	1,016,150	1,014,850
North	129,800	3,100	132,900	131,600
South	810,000	73,250	883,250	883,250
Michigan	28,300	.....	28,300	28,200
Mississippi	109,200	4,950	114,150	114,150
Montana	72,400	.....	72,400	72,000
Nebraska	38,650	.....	38,650	37,850
Nevada	100	.....	100	100
New Mexico	263,100	5,275	268,375	268,475
North Dakota	40,400	.....	40,400	37,100
Oklahoma	†653,100	.....	†653,100	†668,400
Texas	3,277,000	56,000	3,333,000	3,333,000
Dist. 1	57,000	550	57,550	57,550
Dist. 2	164,000	8,900	172,900	172,900
Dist. 3	459,000	26,300	485,300	485,300
Dist. 4	253,000	6,600	259,600	259,600
Dist. 5	44,000	475	44,475	44,475
Dist. 6	147,000	6,200	153,200	153,200
East Texas field	229,000	.....	229,000	229,000
Dist. 7-B	173,000	100	173,100	173,100
Dist. 7-C	176,000	4,300	180,300	180,300
Dist. 8	1,254,000	1,425	1,255,425	1,255,425
Dist. 9	216,000	850	216,850	216,850
Dist. 10	105,000	300	105,300	105,300
Utah	10,900	.....	10,900	11,000
Wyoming	299,150	.....	299,150	302,150
Others	‡100	.....	‡100	‡100
Total U. S.	7,646,950	142,925	7,789,875	7,800,475
Change from previous week, down			10,600	
Canada	†557,000	.....	†557,000	†525,800
Total U. S. production, January 1-March 16			564,170,000 bbl.	
Same period last year (crude plus cond.)			*548,631,286 bbl.	

*Includes 9,830,380 bbl. condensate. †Week ended previous Monday. ‡South Dakota.

CRUDE-OIL STOCKS



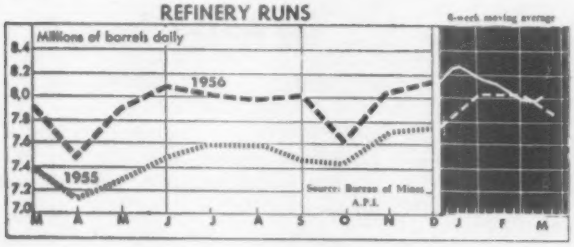
CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

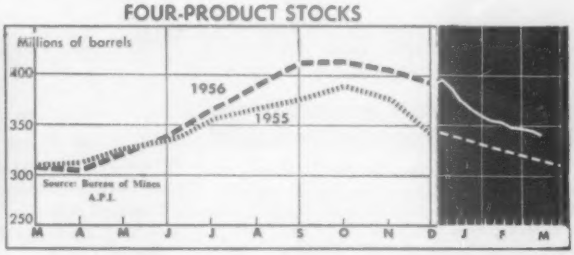
	3-9-57	3-2-57	3-10-56
Pennsylvania Grade	2,414	2,442	2,743
Other Appalachian	1,911	2,008	1,910
Illinois, Indiana, Michigan	9,586	10,092	9,412
Nebraska, North Dakota	1,865	1,888	2,179
Kansas	8,610	9,234	7,754
Oklahoma	21,410	21,399	22,421
Arkansas	2,418	2,296	2,343
Louisiana	19,626	20,517	15,753
North	2,816	2,802	2,472
South	16,810	17,715	13,281
Mississippi	2,121	2,014	3,153
New Mexico	7,233	7,135	8,202
Texas	113,884	114,854	121,987
East Texas proper	9,961	10,305	8,991
West Texas	53,791	53,908	60,411
Texas Gulf	21,172	21,806	22,293
Other Texas	28,960	28,835	30,292
Wyoming	16,724	15,934	15,691
Other Rocky Mountain	6,440	5,639	5,230
California	27,175	27,638	26,791
Foreign	†10,576	10,566	10,424
Total	251,993	253,656	255,993

*Bureau of Mines. †Includes 2,236,000 bbl. in California.

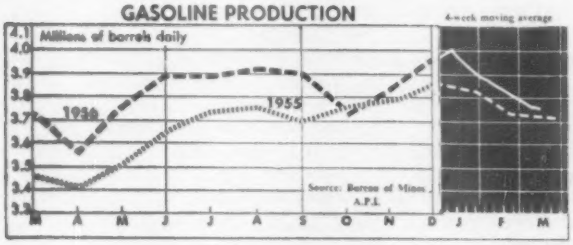
REFINERY RUNS



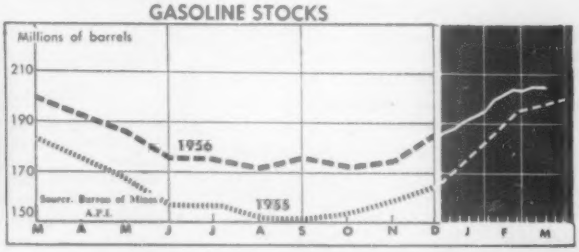
FOUR-PRODUCT STOCKS



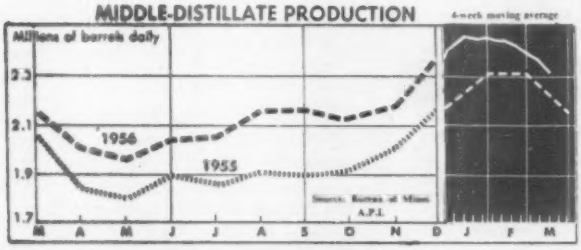
GASOLINE PRODUCTION



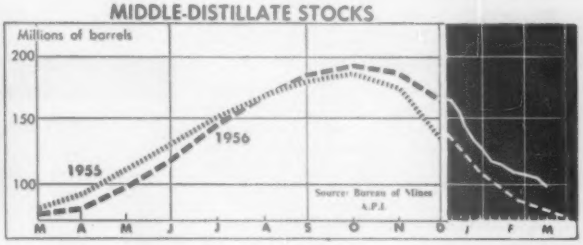
GASOLINE STOCKS



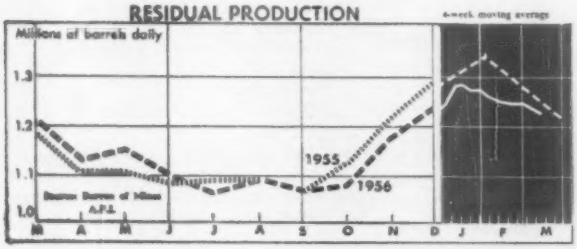
MIDDLE-DISTILLATE PRODUCTION



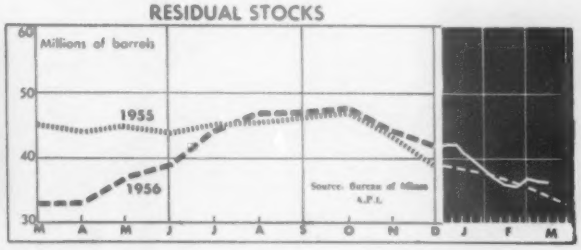
MIDDLE-DISTILLATE STOCKS



RESIDUAL PRODUCTION



RESIDUAL STOCKS



A.P.I. REFINERY REPORT, MARCH 15, 1956

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, March 1956 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,240	545.4	47.4	337.6	205.8	41,604	8,301	24,581	8,104	1,147	447.1	36.6	287.6	217.9
Appalachian:														
District 1	106	42.3	4.9	25.1	9.3	5,136	453	2,063	393	92	34.3	4.0	21.6	7.9
District 2	112	59.0	7.4	20.1	15.3	3,173	378	798	364	104	50.7	7.3	18.7	15.4
Ind., Ill., Ky.	1,412	664.8	74.6	293.5	214.7	36,810	3,556	12,119	4,514	1,394	704.1	74.5	287.3	184.9
Minn., Wis., Dak.	102	48.3	5.4	29.4	8.0	6,984	415	3,682	342	82	39.0	7.0	22.8	6.4
Okla., Kans., Mo.	688	402.3	11.4	173.0	37.3	21,415	775	7,964	873	666	372.5	18.4	159.4	35.3
Inland Texas	280	183.4	10.3	54.1	21.9	8,386	297	1,317	1,749	270	192.4	5.8	55.1	22.2
Texas Gulf Coast	1,894	839.6	113.9	534.3	232.8	28,542	2,774	8,739	5,462	1,983	902.3	113.5	529.9	251.3
La. Gulf Coast	726	325.0	50.7	210.0	52.8	12,970	1,373	4,900	1,625	713	344.6	58.7	173.2	52.9
N. La. and Ark.	99	38.9	5.0	25.0	7.9	5,229	848	1,807	163	71	24.1	4.3	17.3	3.2
Rocky Mountain:														
New Mexico	23	11.0	0.6	4.0	2.7	461	11	87	59	21	10.8	0.4	3.7	2.7
Other Rocky Mtn.	279	125.6	1.1	78.9	38.9	7,933	269	2,372	1,073	262	125.2	5.5	63.4	39.5
California	1,137	440.7	10.3	164.4	370.7	26,946	251	9,170	11,562	1,109	487.0	5.6	167.9	373.9
Mar. 15, 1957	8,098	3,726.3	343.0	1,949.4	1,218.1	205,589	19,701	79,599	36,283	7,914	3,734.1	341.6	1,807.9	1,213.5
Mar. 8, 1957	8,076	3,809.6	347.3	1,904.0	1,225.4	205,782	20,711	83,331	36,383	.....	.....	.....	.....	.....
Mar. 16, 1956	7,986	3,722.3	358.6	1,844.3	1,291.7	195,941	17,959	67,386	35,038	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Crude-Oil and Refinery Prices at Representative U. S. and Foreign Points

REFINED-PRODUCT PRICES

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):

★ Regular (88 octane)	11.75-12.25
★ Premium (96 octane)	13.50-14.00

Gulf Coast (cargoes for coastwise or export movements):

★ Regular (90 octane)	11.00-11.50
★ Regular (92 octane)	11.25-11.75
★ Premium (97 octane)	13.00-13.50
★ Premium (98 octane)	13.25-13.75

California (rack):

Regular (84 octane)	13.1
Premium (93 octane)	14.1
Premium (96 octane)	15.1

Caribbean area (cargoes):

Regular (87 octane)	11.00
Premium (93 octane)	11.75

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

NATURAL GASOLINE*

Group 3:

Grade 26-70	4.5

Breckenridge:

Grade 26-70	4.0

*If 26-70 natural is considered as 100 per cent, prices for lower-vapor-pressure grades increase 2.5 per cent for each unit drop in Reid vapor pressure down to and including 16-lb. Prices for grades below 16-lb. may vary slightly by areas or plants.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):

★ Kerosine 42-44	10.00-10.375
★ Diesel oil (58 d.i. and above)	9.625-9.875
★ Distillate No. 1	9.625-9.875
★ Distillate No. 2	9.00-9.375

Gulf Coast (cargoes):

★ Kerosine 41-43	10.50-11.00
★ Distillate No. 2	10.00-10.50

New York Harbor (barges):

Kerosine 41-43	12.25
Distillate No. 2	11.65
Diesel fuel, 48-52 d.i.	11.95

Caribbean area (cargoes):

★ Distillate No. 2	10.00

WAX (LB.)

Oklahoma (Group 3):

132-135 A.m.p. (semi-refined) in tank cars	6.50

New York (export):

126-130 A.m.p. crude scale (solid in bags or barrels	7.35

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
★ Residual fuel (max. 1% S)	$2.35-2.45
Gulf Coast (cargoes):	
Bunker C fuel	$2.75-3.00
New York Harbor (barges):	
Bunker C fuel	$3.30-3.40
Caribbean (cargoes):	
Bunker C	$2.55
California (rack):	
Bunker C fuel, Los Angeles	$2.75-3.00

LUBRICATING OILS

Mid-Continent (Group 3):	
150-160 bright stock, solvent refined, 0-10 p.p., 95 v.i.	25.5
200 vis. neutral oil, solvent refined, 0-10 p.p., 95 v.i.	22.25
Pennsylvania Grade:	
145-155 vis. at 210, bright stock, 8 color, 25 p.t.	28
200 vis. neutral (180 at 100°), 25 p.t.	26

CRUDE-OIL PRICES

GRAVITY SCHEDULE

	Signal Hill, Calif.	Mid-Cont.*	Gulf Coast Tex.†	West Tex.‡ N.M.	Wyo. (sour)
14-14.9	$2.67	....	....	....	....
15-15.9	2.71	....	....	....	$1.89
16-16.9	2.74	....	....	....	1.94
17-17.9	2.78	....	....	....	1.99
18-18.9	2.82	....	....	....	2.04
19-19.9	2.85	....	....	....	2.09
20-20.9	2.89	$2.75	....	$2.62	2.14
21-21.9	2.93	2.77	....	2.64	2.19
22-22.9	2.97	2.79	....	2.66	2.24
23-23.9	3.01	2.81	$3.44	2.68	2.29
24-24.9	3.05	2.83	3.46	2.70	2.34
25-25.9	3.09	2.85	3.48	2.72	2.39
26-26.9	3.13	2.87	3.50	2.74	2.44
27-27.9	3.17	2.89	3.52	2.76	2.49
28-28.9	3.22	2.91	3.54	2.78	2.54
29-29.9	3.27	2.93	3.56	2.80	2.59
30-30.9	3.32	2.95	....	2.82	2.63
31-31.9	3.38	2.97	....	2.84	2.67
32-32.9	3.44	2.99	....	2.86	2.71
33-33.9	3.50	3.01	....	2.88	2.75
34-34.9	3.56	3.03	....	2.90	2.79
35-35.9	3.61	3.05	....	2.92	2.83
36-36.9	3.65	3.07	....	2.94	2.87
37-37.9	3.68	3.09	....	2.96	2.89
38-38.9	....	3.11	....	2.98	2.91
39-39.9	....	3.13	....	3.00	2.93
40 and up	....	3.15	....	3.02	2.95

*Includes Oklahoma, most of Kansas, North Dakota, West Texas (sweet) and North Central Texas. †Low Cold test Gulf Coast. ‡Sour.

Effective dates: California January 17, 1957, east of California, January 3-January 10, 1957; Pennsylvania Grade, January 16, 1957.

Some crudes in North Central Texas and West Central Texas, are on the intermediate schedules.

FLAT PRICES

Louisiana:	
Bienville (distillate)	$3.05
Ville Platte	3.45
Texas:	
East Texas	3.25
Conroe	3.53
Van	3.08
Pennsylvania Grade:	
Bradford	4.88
Middle District	4.70
Southwest Pennsylvania	4.41
West Virginia	4.23
Buckeye Grade	4.23
Zanesville Grade	3.27
Illinois Basin	3.15
Canada:	
Leduc-Woodbend (flat prices D-2, D-3)	2.78
Redwater (Alta.) D-3	2.67
Smiley-Viking (Sask.)	2.44
Pembina	2.65

FOREIGN

Venezuela:	
Cumarebo, 48°-49.9°, Tucupido	3.75
San Joaquin, 40°-40.9°, Puerto La Cruz	3.37
Oficina, 35°-35.9°, Puerto La Cruz	3.05
Tia Juana medium, 26.5°-26.9°, Amuay*	2.55
Quiriquire, 16.5°-16.9°, Caripito	2.45
Lagunillas heavy, flat, Amuay or Las Piedras*	2.38
Bachaquero, flat, Las Piedras*	2.23

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Middle East, Persian Gulf (cargoes, f.o.b. lifting port):	
Arabian, 36.0°-36.9°, Ras Tanura	$1.97
Iranian, 34.0°-34.9°, Bandar Mashur	1.91
Iranian, 34.0°-34.9°, Abadan	1.86
Iraq, 36.0°-36.9°, Fao	1.87
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.72
Qatar, 39.0°-39.9°, Umm Said	2.06
Middle East, E. Mediterranean:	
Arabian, 36.0°-36.9°, Sidon	2.69
Iraq, 36.0°-36.9°, Tripoli, Banias	2.69
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°-38°	2.60

TANKER RATES PER LONG TON

(Latest reported spot fixtures)

★ Gulf-U.S.N.H., clean (USMC+75%)	$4.99
★ N.W.I.-U.S.N.H., dirty (USMC+70%)	4.59
★ Gulf-France, clean (USMC+65%)	12.62
★ P.G.-Japan, dirty (USMC+70%)	15.30

New Shale Plan Favored

● Congressman Vinson likes Navy's proposal to lease the Rifle, Colo., experimental plant to private industry

WASHINGTON. — A plan to speed up research on oil from shale—without cost to the Government—has the backing of an influential member of Congress.

Rep. Carl Vinson of Georgia, chairman of the House armed services committee, told Navy officials last week he is highly in favor of leasing the former Bureau of Mines research plant at Rifle, Colo., to private interests for a research program.

He is not in favor of the Navy's alternate plan of conducting the research through a contractor at a cost of $14,000,000 over the next 5 years.

The Eisenhower administration dropped research on shale 2 years ago. Now it appears ready to pick up the pieces and start again. Both Interior and the Navy want to handle the project.

The Interior Department hasn't submitted any program to Congress. But last week the Navy laid its plans before Vinson's committee.

Vinson made it clear that he wanted to find out whether the naval shale reserves of Navy lands has any military value. The Navy's $45,000,000 study of the oil reserve in Alaska which found no oil showed that we didn't have what we thought we did there, he said. To that extent the work was justified.

If shale can produce oil needed by the military, Vinson said, the shale reserves are a "tremendous" asset. Ways should be found to produce the oil as insurance against loss of petroleum supplies in the event of war.

How it started . . . The Navy's shale reserves in Colorado and Utah are estimated to hold 22.5 billion barrels of oil. Interior owned the demonstration plant at Rifle, Colo., and spent $23,439,000 over a 10-year period on research.

The Rifle plant was transferred to the Navy last year. Now Interior wants it back, so it can ask for money to resume its studies. It may have the support of the Budget Bureau which sees a legal question as to the validity of the transfer.

It was assumed that industry would get into the shale-oil field when the Bureau of Mines program was dropped in 1955. Union Oil Co. of California has a big program going at nearby Grand Valley, Colo., but Vinson charges that the industry as a whole has not gone into shale to the extent expected 2 years ago.

If the bureau starts a new research effort it will need money. Vinson made it clear he doesn't want to spend the money if he can avoid it. But Navy officials told the committee they are willing to accept the plan to lease the Rifle plant to outside interests and give them access to shale, thus saving the Government all cost.

Navy officials indicated they would prefer to handle shale as they have handled oil operations; that is, through a prime contractor and subcontractors on a cost plus fixed fee contract. An economy-minded Congress is less likely to go along with that than with the attractive - because - less - costly leasing idea.

The only other course is to dispose of the Rifle plant with a loss to the Government, Capt. A. S. Miller, director of naval petroleum and oil-shale reserves, told the committee.

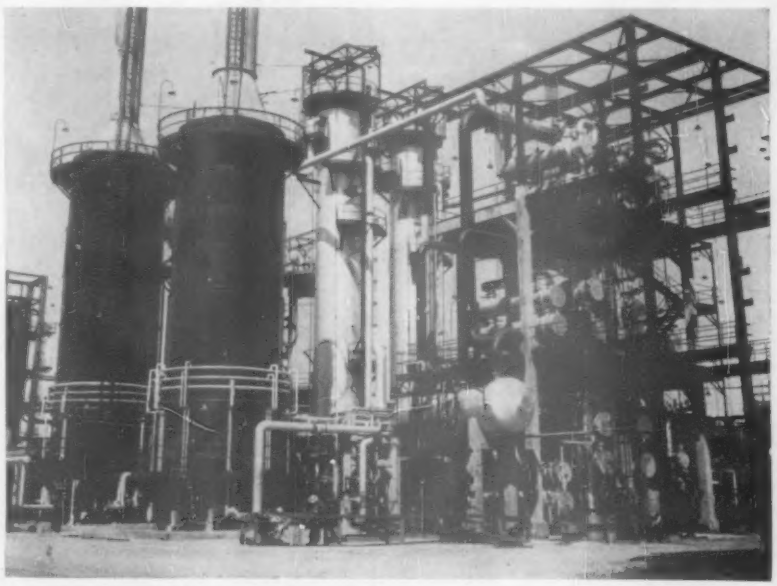
The Navy is looking toward the development of fuels in case of future war, Miller said. It has no intention of entering into competition with the petroleum industry.

Union's experiment . . . At Grand Valley, Union Oil Co. plans to place its $5,000,000 oil-shale retort in full operation May 18. The company hopes to complete research this year. Target date for commercial production is 1960.

The plant was started in 1955 to determine if shale oil could be produced at a cost low enough to compete with petroleum from wells. Since then, Union has spent $8,000,000 in shale-oil research.

Reserves . . . The U. S. Geological Survey has come out with a new report on the extent of oil-shale reserves in the Piceance Creek basin. The report says a 1,400-sq.-mile area in Colorado contains nearly a trillion barrels of oil. This is based on core and surface analyses.

Mahogany ledge, the survey says, yields an average of 45 gal. of oil per ton of shale and holds recoverable reserves of about 7.5 billion barrels. Big reserves are also reported in zones yielding 30, 25, and 15 gal. per ton of shale. First commercial development is expected from the 25-gal. category, where 194 million barrels of oil can be recovered. A whopping 900 billion barrels reportedly can be recovered from the 15-gal. category.



Furfural Has a New Job: This furfural unit is highly efficient in a new way. The Texas Co. uses it to clean up gas oil feed stock for its fluid cat unit at Wilmington, Calif. Normally, a furfural unit is used for lube and distillate fuel manufacture, and cycle stock extraction. The one shown above handles 25,000 bbl. daily. It reduces sulfur and aromatics and extracts metal contaminants, thereby improving the efficiency of the cat-cracking operation and upgrading the end products. Texaco's Wilmington unit differs from others in using centrifugal extractors instead of the conventional packed towers.

CLASSIFIED ADVERTISING

Your MARKET PLACE FOR THE OIL AND GAS INDUSTRY...

UNDISPLAYED CLASSIFIED 26c a word one issue. 10% Discount three or more consecutive issues. $5.00 minimum charge. Blind Box in our care nine words. Payable in Advance.

DISPLAY CLASSIFIED
$18.00 a column inch one issue . . . .
10% Discount three or more consecutive issues.

Address Classified Advertising Material: The Oil and Gas Journal, P. O. Box 1260, Tulsa 1, Okla.

FOR SALE EQUIPMENT

2—30 L's FOR SALE, cash, with or without tools. Young Drilling Co. Box 5733. Sonora, Texas. Phone 2-3411.

CORE DRILLS, SPUDDERS, ROTARIES. New and used equipment. Everything in supplies. Fishing tools rented. Pressey & Son. Pueblo, Colo.

FOR SALE—One National T-20 Rotary Drilling Rig with 6 Cylinder G.M. Unit with C-150 B Pump complete with GMC twin diesel motors, 96' Lee C. Moore derrick, 4,000' new 4½" API Full Hole Grade "E" drill pipe, approximately 2500' used 4" drill pipe. Rig complete ready to drill. Price $75,000. Will finance to responsible person. Contact Clint Hogue, 609 Citizens Bank Building, Evansville, Ind.

FOR SALE—Used—10' x 40' 24,000 gal. horizontal steel riveted and welded gasolene storage tanks, three at Tallant, Oklahoma, $1,000.00 each, seven at Wichita gasolene plant, $650.00 each. Cities Service Oil—Patridge—Bartlesville.

C-34 WALKER-NEER Spudder, with or without 5-7 tools. A-1 condition. Fully equipped. Located at Drumright, Oklahoma. Box 788 or phone 20, Drumright.

COMPLETE PIPE-THREADING shop. Two Landis machines 13⅜" and 7", with building, fully equipped. Bargain. Phone Diamond 3-9563. Lundquist, Box 1215, Tulsa, Oklahoma.

GAS METERS FOR SALE: Foxboro and Westcott Orifice Meters. Large Stock of Late Types and in Good Condition. George Milner, Box 124, Okmulgee, Okla.

DRILLING RIG, for immediate sale at sacrifice. Completely portable, Cardwell "S" draw works with Waukesha GKU engine and double pole telescoping 84' mast on tandem float. Gardner-Denver Pump with International engine and 60 barrel water tank mounted on 32' Lo Boy. International 185 and 210 tractors, together with float, water trailer and house trailer. Call James T. Daniel, Cleburne, Texas, 5-2409 or 5-6348.

NEW AND USED
GAS BOOSTER COMPRESSORS

PACKAGED UNITS on skids complete with engines, V-Belt drives, guards, coolers, scrubbers, controls, etc. Ready for installation.

REAL BARGAINS in used equip. Clarks, Cooper Bessemer, Worthingtons, Ingersoll-Rand, etc.

PROMPT DELIVERY on new units to fit your requirements using Worthington Compressors and Le Roi Engines.

Write, Wire, Phone

Carson Machine & Supply Co.

TULSA OKLAHOMA CITY
GREAT BEND GARDEN CITY

FOR SALE EQUIPMENT

FOR SALE Two 7½ x 14½ x 18 inch Ideal Steam mud pumps. Good, ready for work. Both one steel skid. First $1,750 takes. Located Sinton, Texas. Contact Jack Simmons, General Supt. Al Buchanan Drilling. Phone EM 4-2381, Sinton.

PRICED TO SELL. Hydraulic pipe pulling unit, two speed 6' jacks, spiders, slips, arch bars, sill, breakout tongs, 4 cylinder displacement pump etc. All on '47 2-Ton Dodge Truck. All in good shape and ready to work. Phone S.H. 6-4016, J. E. Bedingfield. Box 563, Artesia, N. M.

STEEL PIPE & TUBING
• CHROME MOLY • CARBON MOLY
• MONEL • CARBON STEEL • STAINLESS
Widest Range of Sizes & Specs in the U. S.
WRITE FOR STOCK LIST
MIDCONTINENT TUBE SERVICE, INC.
2308 Oakton St., Evanston, Ill. DA 8-4030

FOR SALE EQUIPMENT

COOPER WORKOVER-SPUDDER: Complete set of tools, 620 feet casing, 1949 Ford truck. $4,000. C. W. Nole, 6411 E. Haskell Place, Tulsa.

FOR SALE—11,000' Emsco steam rig in good operating condition complete less drill pipe located near Beaumont, Texas. Asking $19,500. Owner, Box 1034, Houston.

SALES AND RENTALS. Used cable drilling and fishing tools, casing, production equipment; from the Southwest's largest stock of oil field supplies. Degen Pipe and Supply Co., Tulsa.

ACCOUNTING (2) MACHINES
BURROUGHS STYLE 720716. Used for crude oil royalty calculations and producing lease run statements. Seven 8 digit storage counters plus multiplying unit. Suitable for numerous clerical functions including pay roll and billing.
National Cooperative Refinery Association
McPherson, Kansas, Phone 2060

BRILL BUYS—THE BEST!

NEAR LONGVIEW, TEXAS
FORMER LACY REFINERY

1—Wyatt 30" x 70' Stabilizer 160# 30 tray
1—5' x 96' tower, 40 tray, 135# WP.
1—2' x 50' tower, 24 trays.
1—Ethyl lead plant.
2—Upshot heaters, 10 mil. BTU/hr.
8—Welded storage tanks, 5,000, 2,000 bbl.
8—Hi-vol pumps, 10 x 7 x 18, 10 x 8 x 12, 6 x 4 x 12, 6 x 3 x 8.

IN STOCK

VESSELS
2—12' x 45' Butane Tanks, 125#
2—12' x 45' Storage Tanks, 25#
1—14' x 21' Clay Tower, 125#
1—8' x 75' Tower, 20 Trays, 25#
1—18" x 32' Tower, 15 Trays, 160#
2—8½' x 25' Tanks 50#

HOT-OIL PUMPS
1 Pacific ITB, 400 gpm—2,000' hd, 735 gpm—3,100' hd.
5 Pacific 5VTB, 612 gpm—600' hd, 324 gpm—480' hd, 308 gpm—516' hd, 193 gpm—389' hd.
1 Pacific HVTB (unused) 1270 GPM—408' Hd.
8J hot oil pump 3 x 9, 13 st, 325 gpm, 4600' hd.

HEAT EXCHANGERS
3—Kellogg Adm. Ftg. Hd. 2200, 1800 Sq. Ft., 315#
4—Kellogg Stel Ftg. Hod. 800, 650, 500 Sq. Ft.
18—GR Fin Tubes, 73 Sq. Ft.
6—Brown fintube exchangers, 300# 140 Sq. Ft. 4-6 chrome.
6—Adm. 785, 742, 425 Sq. Ft.
30—304 SS shell & tube condensers 100-1000 Sq. Ft.

COMPRESSORS
1 Worth LTC-6 800 hp.
3 Penn Comps 100 CFM 500 lbs.
385 CFM 160 lbs.

MISCELLANEOUS
6—Bird Centrifugals 32 x 50, 24 x 38, 18 x 28.
5—Sweetland Filters No. 12, No. 10, No. 7, No. 5.
4—Rotary Vac. Filters, 10 x 12, 8 x 10, 5 x 8.
Lab Petro-Chem furnace 50,000 BTU/hr.
Tremendous selection stainless steel and steel valves 1½"-6".
Goulds 16" pump, 10,500 gpm, 135' hd.

PARTIAL LIST ONLY

WIRE! PHONE! WRITE!
FOR DETAILED CIRCULAR

BRILL EQUIPMENT COMPANY

4101 San Jacinto St., Houston 4, Texas, JA 6-1351
OR
2401 Third Ave., New York 51, N. Y., CYpress 2-5703

FOR SALE EQUIPMENT

FOR SALE: 2 complete workover rigs, Wilson Giant drawworks, Lee C. Moore Derricks, 2 mud tanks, 2 pumps each rig, 1 diesel rig, 1 butane or natural gas rig. Contact J. & M. Oilwell Service, Inc. Lafayette, Louisiana. Phone CEnter 4-4330.

2—55,000 BARREL tanks 5 ring, plates 6' x 20' complete steel support, steel roof, swing lines, ladder, now being dismantled. Price $100 ton, loaded on cars Oklahoma City, Okla. Strictly guaranteed. P. O. Box 1858, W. C. Berry, Tulsa, Okla.

FOR SALE: Wilson double drum Spudder with 55' double telescope mast. Extra good condition, all tools. Sell as skid or will trailer mount. Almost new 4500' ¾" and ⅞" lines. Will help finance. Write P. O. Box 666 or Phone 88, Winfield, Kansas.

FOR SALE EQUIPMENT

ONE MODEL R4 Wichtex Portable Rig, in excellent condition, 2680' practically new Drill pipe. Attractive price. Also, 3000' used Drill pipe, 90c per foot. Phone #740, Sullivan, Indiana.

FOR SALE: 600 tons Carnegie MP-115 42 ft. & Larssen Section II 30 ft. and 40 ft. lengths steel sheet piling located New Orleans and Tampa. Seaboard Steel Company, Tel. RIngling 7-0461, Sarasota, Florida.

VESSEL—New 40-tray ASME code vessel fabricated 1956. Never installed. A-285-C-FBQ Steel, 5'6" diameter and 87'0" tangent. Maximum working pressure 267 psi at 650° F. Available for immediate shipment. The Fluor Corporation, Ltd., P. O. Box 7030, East L. A. Branch, Los Angeles 22, California, c/o Mr. R. M. Savage. Phone: ANgelus 2-6111.

FOR SALE EQUIPMENT

FOR SALE—Cardwell Spudder, RL502, complete with tools, equipment necessary for efficient operation. Price, inventory on request. K & A Drilling Co., Phone 448R, Box 497, Ellinwood, Kansas.

PRICED FOR IMMEDIATE SALE—24 Trace Recording truck with SIE cab complete and SIE Shooting Truck complete. Reply Box J-967, The Oil and Gas Journal, Tulsa, Oklahoma.

OFFERING SUBJECT to prior sale F.O.B. our Eola, Louisiana yard the following unused pipe: 15,000 feet 6 inch Armco. 3,000 feet 8 inch Armco, 1,000 feet 12 inch Taylor, 5,000 feet 8 inch Reynolds Aluminum irrigation pipe. Also—1 Ethyl Tank Plant. Call LUther 4-5291, Tulsa, Okla. or write Anchor Gasoline Corporation, 714 Atlas Life Building, Tulsa.

LIQUIDATION 11,000 BBL. REFINERY

D-X SUNRAY OIL CO., ALLEN, OKLA.

We are now liquidating this modern refinery and can offer equipment at a fraction of its cost.

INCLUDED ARE: 6 Heaters with Chrome Tubes, Welded Towers from 2' to 8' with Operating Pressures up to 475 psi., Reboilers, Accumulators, Heat Exchangers, Hot Oil Pumps, Centrifugal and Steam Pumps, Boilers, Gas and Diesel Generator Sets, New Chrome Heater Tubes, Pipe, Valves, etc.

Your Inspection Is Invited. Write for Catalogue.

HEAT & POWER CO. Inc., 60 E. 42 St., New York 17, N. Y.
310 Thompson Bldg., Tulsa 3, Okla.

OIL TUBULAR GOODS FOR SALE

9⅝" OD New Seamless, Range 2 & 3, T&C, 36#, 40# 43.50#, 47# & 53.50# at special low prices.

7" OD New Seamless, Range 2 & 3, T&C, Casing, 26#, 29# & 32#.

5½" OD 14# New Casing and 2" & 2½" New E.U.E. Tubing.

Several Strings Each Available For Prompt Shipment.
Contact:

A. J. STRUBEL
4946 Murdoch
St. Louis 9, Missouri
DAY: PRospect 3-3020
NIGHT: FLanders 1-8152

LIQUIDATION TIDEWATER OIL COMPANY

Drumright, Okla., Modern 15,000 Bbl./Day Refinery

presently being dismantled — Immediate removal and shipment — exceptional prices — your inspection invited — representatives on premises

COMPLETE UNITS

Houdriflow Catalytic CRACKING UNIT 8800 bbl./day. (new 1952)

Vacuum Crude Oil DISTILLATION UNIT 15,000 bbl./day (new 1953)

POLYMERIZATION UNIT 400 bbl./10#/day

ETHYL BLENDING PLANT 8500 gal. Complete SKIMMING POND

110,000 gal. FOAMITE SYSTEM—complete

VALVE TESTING UNIT Ing. Rand 41X5 TELEMATIC 48 TANK GAUGING SYSTEM

50,000#/hr. COCHRANE WATER TREATING and Deaerating Plant

2—28 Spot CAR LOADING RACKS, capable 10 products each spot

FURNACE TUBES

500—New Croloy #5, 3" to 6⅝" OD 15 to 32' long

500—4", 4-6% Chrome, headers

200—4½", 4-6% Chrome, headers

200—5", 4-6% Chrome, headers

VESSELS

8'x32'3" ACCUMULATOR, 135 PSI @ 650° F.

6'x40' SOAKER, 500 PSI @ 850° F.

20'x28'4" AGITATOR, cone bottom

10,000 bbl. HORTONSPHERE

6500 gal. PROPANE TANK

WELDED TOWERS

8'x34'6"x½" 10 trays

6'x30'x½" 9 trays

5'x58'x⅜" 26 trays

4'6"x30'5"x⅜" 14 trays

PUMPS

HOT OIL 334 GPM, 1,000 PSI (2)

FIRE 2500 GPM at 426' head

CENTRIFUGAL from 60 to 1500 gal. from 40 to 655' head.

STEAM—Hot Oil—Simplex—Duplex

PROPORTIONING—1 to 5 HP

OTHER ITEMS

HEAT EXCHANGERS—196-3100 sq. ft. (25)

NEW STEEL STACKS—240'

53—STORAGE TANKS 1,000-100,000 bbl.

40—STORAGE TANKS 1,000-27,000 gal.

10 Ton OVERHEAD TRAVELING CRANE

PIPE—VALVES & FITTINGS—MACHINE TOOLS—WELDERS—HYDRAULIC JACKS—WAREHOUSE SUPPLIES—HAND TOOLS—LABORATORY EQUIPMENT—CHEMICALS—TRANSFORMERS—GENERATORS—ETC.

Write—Wire—Phone—for complete Information and Catalog

Heat and Power Co., Inc.

NEW YORK OFFICE—60 East 42 St., New York 17, N. Y., Murray Hill 7-5280
TULSA OFFICE—310 Thompson Bldg., Tulsa 3, Okla., Diamond 3-4890.
DRUMRIGHT OFFICE—P. O. Box 587, Drumright, Okla. Phone 569

EQUIPMENT WANTED

WILL BUY used set of 24 trace seismic instruments; truck mounted. Must be in good operating condition. Century Instruments preferred. Also interested in shooting truck and survey equipment. Box J-995, The Oil and Gas Journal, Tulsa, Oklahoma.

WANTED TO BUY

Shut Down Oil Refineries—
Chemical Plants—Gasoline Plants—
Tank Farms—Pipe Lines, etc.

Specialists in liquidation of oil properties for over 25 years. We have worked with most major Oil Companies in the United States. Will purchase for cash.

Brown-Strauss Corp.

HARRY B. STRAUSS
1545 Guinotte Kansas City, Mo.
Telephone HA 1-1000

HELP WANTED

PETROLEUM ENGINEER with Master's Degree, or Doctor's in Chemical, Mechanical, or Petroleum Engineering for research and teaching in Petroleum Production Engineering at rapidly growing southwestern institution. Rank and salary open, twelve months employment possible, consulting work encouraged and available in immediate area. Applications will be kept confidential. Box J-902, The Oil and Gas Journal, Tulsa, Oklahoma.

Operations Engineer

Independent oil company has opening for petroleum engineer with four to seven years experience both technical and administrative for responsible position in planning and control. Knowledge of operating procedures, some valuation work and practical oil and gas law would be desirable. Excellent growth opportunities. Please furnish complete details on qualifications, including starting salary required.

Box J-987,
The Oil and Gas Journal,
Tulsa, Oklahoma.

HELP WANTED

The Saudi Arabian Government is open to engage on an eighteen month contract fully qualified and mature American or Canadian

Petroleum Reservoir Engineer

Petroleum Engineer—Specializing in Production

Petroleum Engineer—Specializing in Natural Gas

Write for application form to:

Director General—Petroleum & Minerals

JEDDAH, SAUDI ARABIA

All applications and data submitted will be kept in strict confidence.

HELP WANTED

FOREIGN EMPLOYMENT. List oil companies, drilling contractors, seismograph contractors, showing where apply foreign jobs. $5.00 cash. OIML Co., Box 2603, Tulsa, Okla.

MANUFACTURERS representative wanted to expand distribution and to serve present accounts in Southwest for complete line of pumping equipment. Write full details to Ralph B. Carter Company, 192 Atlantic St., Hackensack, N. J.

REFINERY YIELD ENGINEER. Mid-Continent refinery has opening for Yield Engineer with some accounting background. Must be capable of calculating estimated process yields. State qualifications and desired salary. Box J-966, The Oil and Gas Journal, Tulsa, Oklahoma.

ESTABLISHED independent oil company desiring to expand engineering department has opportunity for qualified graduate engineer with approximately two years Gulf Coast experience in completions and workovers. Initial replies should include a resume of experience and qualifications. Box J-980, The Oil and Gas Journal, Tulsa Oklahoma.

PROCESS ENGINEER. Modern, growing plant in Gulf South has opening for Process Engineer experienced in catalytic reforming, petrochemicals and economic studies. Furnish record of education, experience, and salary requirements. Write Box J-963, The Oil and Gas Journal, Tulsa, Oklahoma

PROCESS ENGINEER with two to five years' experience in refinery process work to fill position in newly organized Refining Division Technical Section. Work is of broad nature covering selection of processing steps and economic evaluation of processes. Unusual opportunity for advancement. Will pay moving and transportation expense. Liberal retirement, savings, insurance and health plans. Location—Bartlesville, Oklahoma. Replies will be held in confidence. Send resume of experience and salary requirement to Industrial Relations Division, Cities Service Oil Company, Bartlesville, Oklahoma.

GULF OIL CORPORATION
—ENGINEERS—

PETROLEUM
GAS
DRILLING
RESERVOIR
MECHANICAL
PIPE LINE

Subsidiary operating in Venezuela has opportunities for engineers with/without experience. Salary commensurate with experience.

P. O. BOX #35
Bowling Green Station, New York 4, New York

PRODUCTION SUPERINTENDENT

Executive Production Superintendent needed by large independent oil company. Man selected must have Petroleum Engineering Degree and know purchasing, drilling, well completions and production practices. Age to 45. Minimum of 12 years experience, mostly on Gulf Coast. Salary depending on experience. All information confidential. Send complete resume to

BOX J-968,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA

OPERATING ENGINEER
For Writing Operating Manuals

To compose operating instructions for petroleum refinery, chemical and petrochemical plants. Will also assist in activities of New York Operating Department.

Graduate Chemical or Menchanical Engineer with minimum 5 years experience in performing similar work with petroleum refiner or contractor. This is a challenging position with an excellent opportunity for growth.

Please airmail in confidence complete chronological resume, including education and employment, salary history and salary requirements, to Personnel Department

HYDROCARBON RESEARCH, INC.
115 Broadway New York 6, N. Y.

HELP WANTED

VALUATION ENGINEER for pipeline company headquartered in Los Angeles, California, requires engineering degree and 5 years minimum pipeline experience. Knowledge of ICC accounting desired but not essential. Excellent employee benefits. Box J-975, The Oil and Gas Journal, Tulsa, Oklahoma.

Petroleum Geologist

Established Oil Company desires Geologist for employment in West Texas area. Must know area and have three to six years of active experience in subsurface mapping and interpretation. Excellent opportunity for advancement. Salary will be commensurate with ability and experience. Reply should state age, education, experience, and salary desired.

BOX J-996,
THE OIL AND GAS JOURNAL,
TULSA, OKLAHOMA.

Operators For Oil Refinery Expansion

COMMONWEALTH OIL REFINING COMPANY, INC.

Completing expansion to 60,000 B/D, new refinery near PONCE, PUERTO RICO Minimum experience required: Three years, preferably on Houdriflow, Cat Cracking, Cat Reforming, Cat Poly, Gas Recovery, SO_2 Treating Units. Write, giving work experience, qualifications, units operated to:

Commonwealth Oil Refining Company, Inc.
P. O. Box 1406
Ponce, Puerto Rico

PETROLEUM ENGINEERS

for Reservoir & Production engineering in varied types active fields in COLOMBIA, SOUTH AMERICA. Excellent salary, allowances, opportunity obtain additional experience & advancement. Minimum 2 years exp.

Forward Personal data, college transcript, to:

C. L. LAUE
Colombian Petroleum Co.
375 Lexington Ave., New York 17, N. Y.

SOUTH AMERICA

• Career employment with Major American Oil Companies • Salaries Open • Cost of Living Allowance • Monthly Bonus.

NO U. S. INCOME TAX
OUR FEE AND TRANSPORTATION PAID
Maximum Age to 46

- Engineers, All types—Degree required. Exp. or inexperienced.
- GEOPHYSICIST, Degree—3 to 5 yrs. Exp.
- GEOLOGIST, Degree—Age to 32—Single.
- TOOLPUSHERS, 3 to 5 yrs. experience.
- MECHANIC GAS, 5 yrs. experience.
- MECHANIC DIESEL, 4 yrs. experience.
- FOREMAN CONNECTION, 3 yrs. experience.
- FOREMAN ELECTRICAL, 3 yrs. experience.
- SUPERVISOR, OIL HANDLING, 3 yrs. exp.
- MUD TECHNICIAN, 1 yr. exp. Age to 32.
- CLERICAL, Male and Female, Oil exp. Age to 32. Must be single.

All information confidential.
Send complete resume to:
OVERSEAS EMPLOYMENT SECTION

CHAS. J. LOVELESS
PERSONNEL SERVICE
616 S. Main • Tulsa, Okla. • GI 7-3193

HELP WANTED

PETROLEUM ENGINEER—Aggressive independent oil and gas company has opening for Petroleum Engineer for reserve evaluation. Unusual opportunity for qualified man. Experience desirable but not essential. Furnish resume of experience and education. All replies confidential. Corpus Christi Area. Box J-999, The Oil and Gas Journal, Tulsa, Oklahoma.

REFINERY ENGINEERS. Independent Mid-Continent refinery has openings for Chemical and Process engineers with refinery experience. Process engineering and economic analysis experience very desirable. B.S. degree. Give details and salary consideration. Box J-965, The Oil and Gas Journal, Tulsa, Oklahoma.

ENGINEERS—Chemical, Mechanical, Petroleum or Gas Engineering graduates. Major Oil Company will interview applicants for openings in natural gas department. Their area of operations consists of Mid-Continent, Louisiana and Gulf Coast. Salary to suit previous experience. Our employees are aware of this ad. Box K-101, The Oil and Gas Journal, Tulsa, Oklahoma.

CHEMICAL ENGINEERS

New staff positions, created by company expansion, are open for chemical engineers with up to ten years experience in refining or petrochemicals technical service, process control, economics or process design.

Write, giving resume, to

PONTIAC REFINING CORP.
P. O. BOX 1581
CORPUS CHRISTI, TEXAS

Micro-Paleontologist and Stratigrapher

Require 6 to 10 years experience plus ability to conduct regional geological studies and to speak Spanish.

Field Geologist

Require 4 to 6 years experience in surface geology and field mapping. Ability to speak Spanish is essential.

Both positions are with a small independent oil company operating in South America. Excellent living conditions. Send full particulars on education and experience, with references to:

James L. Carlton, Jr.
P. O. Box 455
Casper, Wyoming.

REFINERY SUPERINTENDENT

Opportunity for Present Process Engineer

Independent refiner with modern plant and excellent growth prospects needs refinery superintendent. Will report to refinery manager and supervise all operations and maintenance. Definitely interested in mature chemical engineer with several years process engineering experience in modern rfinery who has the necessary personality, judgment and energy to step directly into high level refinery supervision. Previous supervisory experience desirable but by no means essential for the right man. North Central States location with excellent living conditions.

For consideration, send resume to:
FRED P. LOBBAN
GEORGE ARMISTEAD and COMPANY
1200—18th Street, N. W.—
Washington 6, D. C.
NO FEE

HELP WANTED

LIVE AND WORK IN THE LAND OF 10,000 LAKES

Our Expanding Independent Refinery, located in a Twin Cities suburban area has openings for

CHEMICAL ENGINEERS
MECHANICAL ENGINEERS

These positions offer challenging assignments and unusual opportunities for professional development in a medium sized, growing company. Excellent salaries, many employee benefits. Good living conditions, excellent schools and unsurpassed recreational facilities.

CALL OR WRITE
T. C. KNIGHT
Personnel Manager
NORTHWESTERN REFINING CO.
ST. PAUL PARK, MINNESOTA
Tel. GLenview 9-9771

SITUATIONS WANTED

PRODUCTION SUPERINTENDENT; extensive experience both domestic and foreign. Age 45, available now. Box J-997, The Oil and Gas Journal, Tulsa, Oklahoma.

DRILLING SUPERINTENDENT; 25 years experience in all drilling problems, worked in U. S., Canada, South America, Middle East. Box J-998, The Oil and Gas Journal, Tulsa, Oklahoma.

DISTRICT GEOLOGIST: Age 30, veteran, married, B.S. degree, experienced in West and West Central Texas, Southeast New Mexico, some in Canada and Gulf Coast, desires position with aggressive small company or independent in Texas. Excellent references. Box K-100, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM ENGINEER, 36, BS, eleven years experience including drilling, workovers, primary and secondary recovery, consulting and evaluation; gas, distillate, oil. Family man. Prefer production engineering. Box J-992, The Oil and Gas Journal, Tulsa, Oklahoma.

CHIEF ACCOUNTANT—Desires position with independent oil producing or drilling company—BSC—Law Student—15 years' experience—will relocate. Box J-973, The Oil and Gas Journal, Tulsa, Oklahoma.

EXPLORATION MANAGER experience geology, leasing, drilling, estimates, policy, programs, domestic or foreign. Box J-971, The Oil and Gas Journal, Tulsa, Oklahoma.

PRODUCTION SUPERINTENDENT — Petroleum Engineering degree: 31 years experience in all phases drilling, workover, production management. Familiar with Texas, Oklahoma and Kansas operations and problems. Married. Available at once. Desire connection with progressive Oklahoma Independent or will consider relocation. Box J-976, The Oil and Gas Journal, Tulsa, Oklahoma.

QUALIFIED LANDMAN: 8 years experience, major and independent companies, many areas, 33. Excellent recommendations: Box J-974, The Oil and Gas Journal, Tulsa, Oklahoma.

SITUATIONS WANTED

PETROLEUM ENGINEER, Secondary Recovery: Six-years supervisory experience; 3-years field, 3-years office. B.S. degree. Age 31, presently employed. Box J-989, The Oil and Gas Journal, Tulsa, Oklahoma.

GRADUATE PRODUCTION ENGINEER. Desires responsible position with aggressive independent or small oil company. 10 years intensive and varied production engineering experience with major company in Permian Basin. Married, 36 years old, employed. Box J-991, The Oil and Gas Journal, Tulsa, Oklahoma.

PLAT SHEETS

NEW KRAFTBILT PLAT SHEETS will solve your plotting problems. Choose from a broad selection of sizes, scales and paper types. Contrasting lines are sharp and clean. Bond, ledger and tracing papers are top quality. Our line is complete! Ask for Bulletin 57-W. Ross-Martin Co., P. O. Box 800-A, Tulsa, Okla.

GEOPHYSICAL SERVICE

EXPERIENCED INDEPENDENT geologist going to Caracas, Venezuela, June. Could handle retainer for week's assignment. References. Reply Box J-993, The Oil and Gas Journal, Tulsa, Oklahoma.

REAL ESTATE

BEAUTIFUL thirty-acre Estate, northern Minnesota. Fifteen hundred feet lakeshore includes point. Caretakers two bedroom house, guest cottage, 5 car garage, boathouse, large outdoor barbecue, excellent fishing, airport nearby, many extras. Box 2392, Tulsa, Okla.

WAREHOUSE FOR SALE
BRISTOW, OKLA.—excellent truck & rail loading facilities. Nice office & display room with about 4,000 sq. ft. total area. Adjoining lots 70 x 90 available at low rental. Small mfg. or distributor of oil field equip. or supplies, service, etc. can use. For more details contact C. E. Erb, 331-34 Okla. Natural Bldg., Oklahoma City, Okla. KNAPTON BUSINESS BROKERS.

BUSINESS OPPORTUNITIES

SMALL PENNA. CORP., capital stock $500,000.00, 3 rigs on site. Holes incomplete, approximately 45,000 acres, leased. Desire more capital to complete wells. Box J-970, The Oil and Gas Journal, Tulsa, Oklahoma.

FINANCIAL CONTACTS. Underwriters. Brokers, Private Finders of Capital reached. No shopping. Confidential. FREE ENTERPRISE ASSOCIATES, 617 51st St., Brooklyn, N. Y.

ROYALTIES

PRODUCING ROYALTY

For Sale By Owner.

Average monthly income last yr. $178.28. Price $7500.00. Also for sale 1865 ac. oil lease favorably located So. Tex. area, 3 productive sands to 4500 ft. $5. per ac. 1/24 override.

W. H. GEE,
P. O. Box 2411, San Antonio, Texas.

PRODUCTION WANTED

WANTED: Oil production 100 bbls. and up, any size, prefer Okla., N. M., Tex., Colo. or Kan. B. Thurston, 1427 Princeton NE, Albuquerque, N. M.

WANT TO BUY—Oil Properties, settled or semi-settled production, 100 to 5,000 barrels daily in Oklahoma and Kansas. Contact Morris Sitrin, 1215 First National Building, Tulsa, Oklahoma.

WANTED

WANTED—WILDCAT ROYALTIES, fee or override under major company blocks scheduled to be drilled. Any size. We are principals. Box 1034, Houston, telephone CApitol 8-6608.

SERVICES

DIRECTORY OF Oil-Industry Personnel, Venezuela and Colombia, 60 pages, just out. Airmailed $10 (please remit with order) VOSA, Apartado 3963, Caracas, Venezuela.

SCOUTING

VENEZUELAN OIL SCOUTING AGENCY

Reports—maps—newsletter

Cable: VOSA, Caracas
Mail: Apartado 3963
N. VanMiddlesworth
Phone: 54 48 02

BUSINESS OPPORTUNITIES

TV FILM VENTURE

A new, different, exciting, and fascinating business needs imaginative investors to enlarge corporation. Smaller investments net bigger returns.

Box J-994, The Oil and Gas Journal, Tulsa, Oklahoma.

BUSINESS SERVICE

Delaware Corporations formed and serviced. American Guaranty & Trust Company, P. O. Box 487, Wilmington, Delaware.

LEASE AND DRILLING BLOCKS

NEED CAPITAL to prove 160 acre lease in Creek County, Okla. Will sell half interest. Will drill thru Prue and Red Fork sands to Bartlesville sand. Frank Root, Rt. 2, Box 113, Bristow, Okla.

160 A. OIL LEASE. Carbon Co., Utah, on structure near gas wells. Bargain. R. Barnsley, 950 Lincoln Ave. Palo Alto, Calif.

HALF INTEREST in Drilling Block: A well drilled for gas showed oil at 600 ft. in the Berra sand. Oil rose over night to 25 ft. Gas pressure on line was 275 lb. Well was not shot. Will lease up to 2,000 acres and give one-half interest in return for drilling and completing 4 wells. Write Hobart Lyon, R.F.D. 4, Lucasville, Ohio.

BARTLESVILLE AND ARBUCKLE production for sale: Eight wells, 480 acres, proven locations to drill. Excellent water flood possibilities; lots of gas. Montgomery County, Kansas; telephone 436M, Independence, Kansas.

EXPERIENCED OPERATOR WILL SELL interest to finance drilling shallow well on proven lease near Coweta, Okla. Box 362, Coweta, Okla.

TEXAS PROPERTY with good producing wells available for further development. Cost approximately one million dollars. Smaller situations. Box 2586, Fargo, N. D.

OIL, GAS AND MINERAL LEASES available in Dell City area of Hudspeth County, Texas. U. S. Geological Survey Map shows anticlinal axis nearby favorable for oil-gas structure. Am fee landowner of over 2000 acres. Write quickly to: Jefferson G. Smith, 715 Littlefield Building, Austin 13, Texas.

CHAVES COUNTY, N. M.
MAJOR OIL STRUCTURE

MAJOR CO. BLK.: Well to drill PENN, DEVONIAN & ELLENBURGER OIL ZONES. Subsurface & Base Map Indicate Major Field. Royalty & Close In Interests. Data on request to those who Value Great Potential.

W. F. PETERMAN, Geologist
Exploration 1918-1957 Engineering
PORTALES NEW MEXICO

Do You Read Oil and Gas Journal Classified Pages?

. . . So do most of our other Subscribers!

That's why these pages are called:

The Market Place Of The Oil Industry

—to buy or sell equipment—to find personnel or a position—to buy or sell production, royalties, acreage or real estate—for business opportunities—or to publicize professional services, maps, or field records.

And the cost is reasonable:—26¢ per word or $18. per column inch. Minimum: $5. for word ad or 1 in. for display ad. 10% reduction for running same copy in three or more consecutive issues. This ad is 2 columns wide and 4 inches deep, or 8 column inches.

We will be glad to help you phrase your classified ad or give you the cost of running it. Send your inquiry or copy now:

WRITE: The Oil and Gas Journal 211 South Cheyenne Tulsa, Oklahoma

Successful Wildcats

TEXAS GULF COAST

Galveston County: Hassie Hunt Trust 1 Ben Sass et al, Lemuel Crawford Sur. 453, A-48. IP 6,000 M.c.f. daily, open-flow potential, GLR 13,020 cu. ft. per bbl., 51.4°, perforations 14,247-53 ft. TD 16,000 ft. (New pay and extension in Alto Loma area.)

The Texas Co. 1 Merrill NCT-1, Burrell Franks Sur., A-65. IP 340,000 M.c.f. daily, open-flow potential, spray 44.2° condensate, perforations 6,034-40 ft. (basal Miocene). TD 8,450 ft. (New pay in Caplan field.)

Nueces County: Spartan Drilling Co. 1 Thomas, Section 52, George H. Paul Subd., Driscoll Ranch. IP 160 BOPD, 9/64-in., 36.1°, GOR 890 cu. ft. per bbl., perforations 7,173-77 ft. TD 8,100 ft. (New field—4 miles southwest of Robstown.)

Republic Natural Gas Co. 3-A Bevly, William J. Cody Sur. 165, A-967 (3 miles south of Clarkwood). IP 186 BOPD, 9/64-in., 39.1°, GOR 1,973 cu. ft. per bbl., perforations 7,418-19 ft. TD 8,402 ft. (New pay in Baldwin field.)

Willacy County: Superior Oil Co. 7 Chess Todd, Lot 3, Blk. 2, Narcisso Tract 4, San Juan de Carricitos Grant, A-9. IP 1,935 M.c.f. daily and 29.9 BC per day, ¼-in., 58.6°, perforations 6,419-25 ft. TD 8,650 ft. (New pay in Cess field.)

WYOMING

Campbell County: Arthur L. Schlaikjer 1 Bea Slattery, C NW SW 24-49n-96w. IPP 35 BOPD, Newcastle discovery, new field. TD 6,910 ft. Lakota.

ADVERTISERS IN THIS ISSUE

ACF Industries, Incorporated, Valve Division 88
Aero Design and Engineering Company 270
Alco Products, Inc. 59
Aluminum Co. of America 255
American Airlines, Inc. 19
American Blower Division of American-Standard 51
American Bosch, A Division of American Bosch Arma Corporation 36
American Steel & Wire Division 60, 61
Anaconda Wire & Cable Company 246
Anderson Company, The V. D. 216
Armour Chemical Division Armour and Company 236, 237
Armstrong Machine Works 85
Atlantic Refining Company, The 28

Babcock & Wilcox Company—Tubular Products Division, The 63
Bakelite Company A Division of Union Carbide and Carbon Corporation 241
Baker Oil Tools, Inc. 232
Baker-Raulang Company, The 12
Barco Manufacturing Company 285
Bechtel Corporation 209
Bethlehem Supply Co. 184
Bingham Pump Company 46, 47
Blyth & Co., Inc. 297
British Petroleum Company Limited, The 301
Brodie Co., Inc., Ralph N. 217
Brown & Root, Inc. 175
Bucyrus-Erie 76

Cabot Shops, Inc. 20
Canadian Bank of Commerce, The 215
Caterpillar Tractor Co. 221
Chain Belt Co. 311
Chapman Valve Mfg. Co., The 83
Chicago Bridge & Iron Company 169
Cities Service Oil Co. 58
Clark Bros. Co., One of the Dresser Industries 26, 27
Classified Advertising 334, 335, 336, 337, 338
Climax Engine and Pump Mfg. Co. 24
Continental-Emsco Company 38, 39
Continental Motors Corp. 49
Cooper-Bessemer Corp., The 172, 173
Crane Packing Company 272
Crosby Laughlin LeBus 313
Crose Manufacturing Co., Inc., M. J. 230

Darling Valve and Mfg. Co. 9
Davison Chemical Company Division of W. R. Grace & Co. 48
Dean Hill Pump Company, Inc. 90
Dearborn Chemical Company 87
Detroit Controls Corporation 218
Diamond Chain Company, Inc. 286
Dicalite Division Great Lakes Carbon Corporation 314
Dominion Bridge Company Limited 254
Dowell Incorporated 98, 183, 292
Dresser Manufacturing Division 321
Drilling & Service, Inc. 316
du Pont 5, 33

Eaton Manufacturing Company, Axle Division 57
Edward Valves, Inc. 310
Ehrsam & Sons Mfg. Co., The J. B. 256
Engineering Controls, Incorporated 231
Ever-Tite Coupling Co., Inc. 224

Fabri-Valve Company of America 235
Fairbanks, Morse & Co. 4
Falk Corporation, The 74
Farrel-Birmingham Co., Inc. 253
First National Bank & Trust Co. of Tulsa, The 230
Fleet-Line Co. 229
Flexitallic Gasket Company 189
Flint Steel Corporation 309
Floridin Company 91
Foxboro Company, The 30, 31
Frontier Chemical Company 32

Gardner-Denver Company 296
Gates Rubber Co., The 291
General American Transportation Corporation 181
General Paint Corporation 266
Girdler Company, The 1
Goulds Pumps, Inc. 219
Grancell, I. H. 234
Graver Tank & Mfg. Co., Inc. 66
Guiberson Corporation Inside Back Cover

Haering & Co., Inc., D. W. 89
Halliburton Oil Well Cementing Co. 34, 35
Hamer Valves, Inc. 277
Hammond Iron Works 244
Harrisburg Steel Co. 214
Hudson Engineering Corporation 202
Hughes Tool Co. Back Cover
Humble Oil & Refining Co. 62
Hutchison Manufacturing Co. 308

Inferno Co., The 233
Infilco Incorporated 226
Ingalls Shipbuilding Corporation, The 303
Ingersoll-Rand 54
International Harvester Co. 52, 53
International Nickel Company, Inc., The 73

Jones & Laughlin Supply Division 13
Jones Company, The S. M. 16, 17
Joy Manufacturing Co. 77

Kaiser Aluminum & Chemical Sales, Inc. 258, 259
Kellogg Co., The M. W. 80, 81
Kinzbach Tool Co., Inc. 308
Kohler Co. 216
Kraloy Plastic Pipe Co., Inc. 299

Larkin Packer Company, Inc. 260, 261
Link-Belt Company 15
Lone Star Steel Company 176
Lunkenheimer Co., The 41

Mack Iron Works Company, The 233
Mack Trucks, Inc. 307
Magnet Cove Barium Corp. 55
Magnetrol, Inc. 235
Manning, Maxwell & Moore, Inc. 67, 243, 262, 263, 340
Manzel Division of Houdaille Industries, Inc. 269
Marsh Instrument Co. 70
Mercoid Corp., The 223
Midwest Piping Company, Inc. 40
Minneapolis-Moline 294
Mission Mfg. Company 283
Mueller Co. 44
Murray Iron Works Company 191
Nash Engineering Co. 240
National Airoil Burner Co., The 312
National Foam System, Inc. 276
National Supply Co., The 317, 318, 319, 320
Naugatuck Chemical Division of United States Rubber Company 252
Nordberg Mfg. Co. 71
Nordstrom Valve Division, Rockwell Manufacturing Company Inside Front Cover

Oakite Products, Inc. 266
Ohio Injector Company 248
Oil Center Tool Co. 64, 65
Oil Equipment Mfg. Co., Inc. 220
Oil Well Supply Division 6
Olin Mathieson Chemical Corporation, Industrial Chemicals Division 78
Otis Pressure Control, Inc. 268

Pacific Pumps, Inc. 201
Parkersburg Rig & Reel Co. 279
Parsons Company, The Ralph M. 45
Peerless Pump Division of Food Machinery & Chemical Corporation 187
Peerless Supply Co., Inc. 229
Pennsylvania Salt Manufacturing Company of Washington 222
Petreco A Division of Petrolite Corporation 281
Petro-Chem Development Co., Inc. 276
Petroleum Electric Power Assn. 273
Petroleum Equipment Suppliers Association 68, 69
Powell Valves 245
Price Company, H. C. 92
Procon Incorporated 250
Puget Sound Fabricators, Inc. 230
Pure Oil Company, The 239

Refinery Engineering Company 23
Refinery Supply Co., The 315
Republic National Bank of Dallas 308
Republic Rubber Division of Lee Rubber & Tire Corp. 56
Republic Steel Corporation 96, 97
Reynolds Metals Company 25
Ridge Tool Company, The 249
Rockwood Sprinkler Company 251
Shell Oil Company 284
Smith Corporation, A. O. All Petroleum Products 196, 197
Socony Mobil Oil Co., Inc. 75
Southwestern Engineering Company 205
Stearns Co., N. C. 223
Stearns-Roger Mfg. Co., The 242
Stewart & Stevenson Services, Inc. 322, 323
Stoody Company 206, 207
Sun Shipbuilding & Dry Dock Company 86
Thomas Flexible Coupling Co. 302
Thompson Tank & Manufacturing Co., Inc. 315
Thornhill-Craver Co. 37
Timken Roller Bearing Company Steel and Tube Division 11
Torrington Company, The 267
Tretolite Company, A Division of Petrolite Corporation 8
Tube-Kote, Inc. 274, 275
Tube Turns, Inc. 21, 22
Twin Disc Clutch Co. 79

Union Carbide and Carbon Corporation Bakelite Company 241
Union Switch & Signal Division of Westinghouse Air Brake Company 14
Unit Crane & Shovel Corporation 280
United States Rubber Company 84
United States Rubber Company, Naugatuck Chemical Division 252
United States Steel Corporation—American Steel & Wire Division 60, 61
Oil Well Supply Division 6
Universal Oil Products Co. 10, 42, 43, 247

Valley Electric Corp. 313
Valve Engineering & Supply Company 229
Vogt Machine Co., Henry 50

Wagner Electric Corporation 82
Walworth Co. 7
Warner Lewis Company 193
Warren Petroleum Corporation 94
Waukesha Motor Company 298
Well Equipment Mfg. Corp. 72
Western Supply Company 29
Wheatland Tube Company 238
White Diesel Engine Division The White Motor Company 18
Wichtex Machinery Company, Inc. 275
Williams & Co., J. H. 265
Williams Company, W. Horace 324
Wisconsin Motor Corporation 304
W-K-M Manufacturing Company, Inc., A Subsidiary of ACF Industries Incorporated 88
W-S Fittings Division, H. K. Porter Company, Inc. 282
Zink Company, John 264

LEGAL

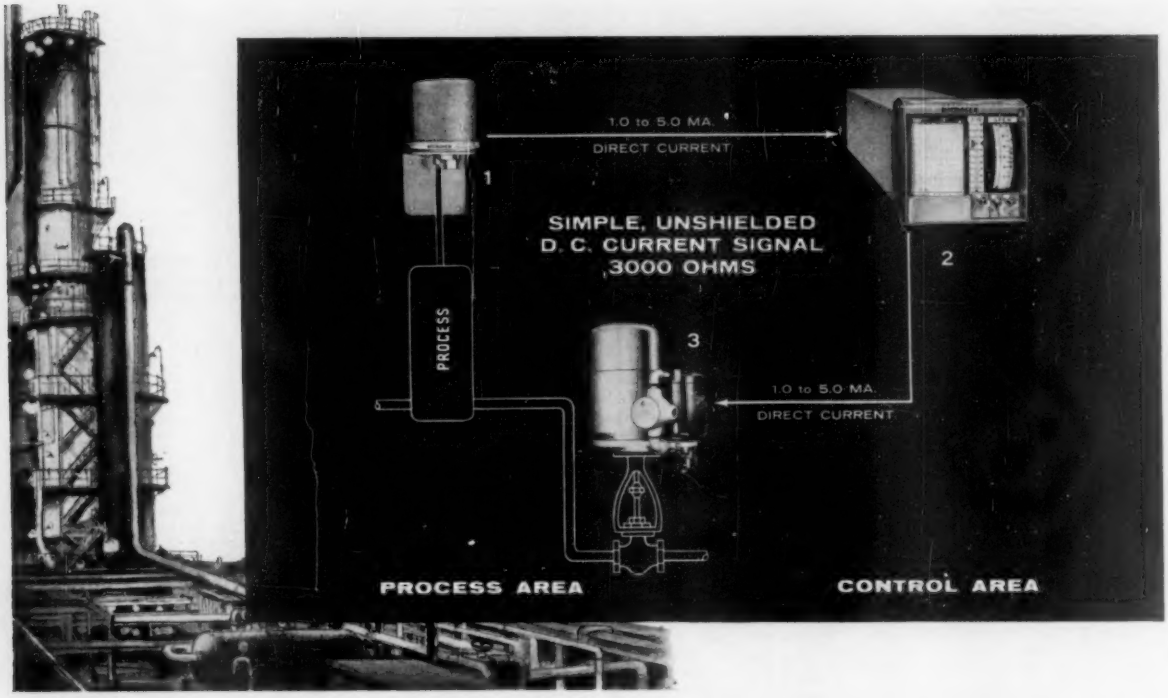
U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Washington 25, D. C. Notice is hereby given that two separate parcels of land, comprising 40 acres within the known geologic structure of the Cranberry Lake Field, and 2.18 acres within the known geologic structure of the Winterfield Field, Michigan, will be offered for oil and gas leasing through competitive bidding to the qualified bidders of the highest cash amounts per acre at 1:00 P.M., E.S.T. April 10, 1957 when bids will be opened. Details of the lease offering, description of the lands, how and where to submit bids, and bid forms may be obtained from the Acting Manager, Eastern States Land Office, Bureau of Land Management, Washington 25, D. C., H. K. Scholl, Acting Manager.

LEGAL

SEALED BIDS will be received until 10:00 A.M. Mountain Standard Time, and opened at that time in the office of the Navajo Indian Agency, Window Rock, Arizona, on the following tracts of Navajo allotted lands on the dates as indicated as follows:

GROUP 1: Bids to be Opened
Tract Nos. 1 to 210 inclusive 4-25-57
GROUP 2:
Tract Nos. 211 to 399 inclusive 5-16-57
GROUP 3:
Tract Nos. 400 to 564 inclusive 6-6-57

The details of the lease offering and how and where to file bids may be obtained by addressing the inquiry to the General Superintendent of the Navajo Indian Agency, Attention: Branch of Realty, Window Rock, Arizona.



Let's look at a typical control loop of the 'American-Microsen' *ELECTRONIC PROCESS CONTROL SYSTEM*

This all-electronic dc system of miniature-type units assures the instrument engineer of 1) better control; 2) greater flexibility; 3) lower initial costs; 4) lower operating costs. The typical control loop above demonstrates the simplicity and functions of the system.

1. *Transmitter.* 'American-Microsen' transmitters are used for measuring pressure, temperature, differential pressure, liquid level, flow, and other process variables. The "Microsen" balance creates a stable dc signal for long distance transmission. Transmitters have no bearing pivots or linkages — assuring sensitivity and repeatability of measurement. Small size is made possible by printed circuitry and miniaturized components. The unit can be installed on meter piping, pipe pedestal or vertical surface.

2. *Controller.* A single unit combines all functions of measuring and recording or indicating the input signal; producing the control signal; and allowing manual-automatic process operation. Separate plug-in chassis provides the following functions: *A.* Records or indicates process variable. Strip or card chart recorder chassis available. *B.* Produces proportional, reset and rate control actions to regulate the variable. All control settings are calibrated. *C.* Permits switching to manual operation during start-up or emergency conditions, with true "bumpless" transfer from manual to automatic control.

Transistorized design increases reliability and service life. Miniaturization and consolidation of control functions reduces panel cost and wiring expense.

3. *Electro-Hydraulic Control Valve Operator.* A power unit with position feedback that operates slip-stem control valves. No compressed air is needed. Mountable on standard yokes supplied with conventional slip-stem control valves with bodies of single or double-seated construction, with V-port, parabolic, needle and equal percentage plugs, including valves of 4" stroke, and force available up to 3,250 lbs.

Where required, the American-Microsen Electro-Pneumatic Valve Positioner or the Electro-Pneumatic Transducer can be supplied.

In automating your processes for higher product quality and greater operating economy, you want the better control and simplified servicing provided by the American-Microsen Electronic Process Control System. We invite you to meet with one of our sales engineers to determine the best equipment for your service. Write for literature.

MANNING, MAXWELL & MOORE, INC.

MAXWELL MANNING M&M & MOORE INC TRADE MARK

INDUSTRIAL CONTROLS DIVISION • STRATFORD, CONNECTICUT

MAKERS OF 'AMERICAN-MICROSEN' ELECTRONIC INSTRUMENTS FOR MEASUREMENT, TRANSMISSION AND CONTROL

HOLDS PRESSURES Automatically

GUIBERSON Type E TUBING STRIPPER

FOR LOW AND MEDIUM PRESSURES

Low in height and compact, this new Guiberson stripper speeds up running or pulling tubing because it seals automatically. Rubber requires no tightening or adjustment. Cup-shaped rubber is specially designed to be tear resistant — specially compounded to resist damage from oil, gas or well fluid. Reinforced with steel wires and bushing.

Bayonet-type latch on cover plate makes it easy and quick to remove or install rubber. Handles lock the cover on the body. Cover plate accommodates Guiberson Tubing Spider. Body may be tapped for two 2″ side outlets on special order. Pressure rating, 750 p.s.i. working pressure, 1500 p.s.i. test pressure. For 2″, 2½″ and 3″ tubing, and for flange sizes 6″-400, 6″-600, 6″-900, 8″-400 and 8″-600.

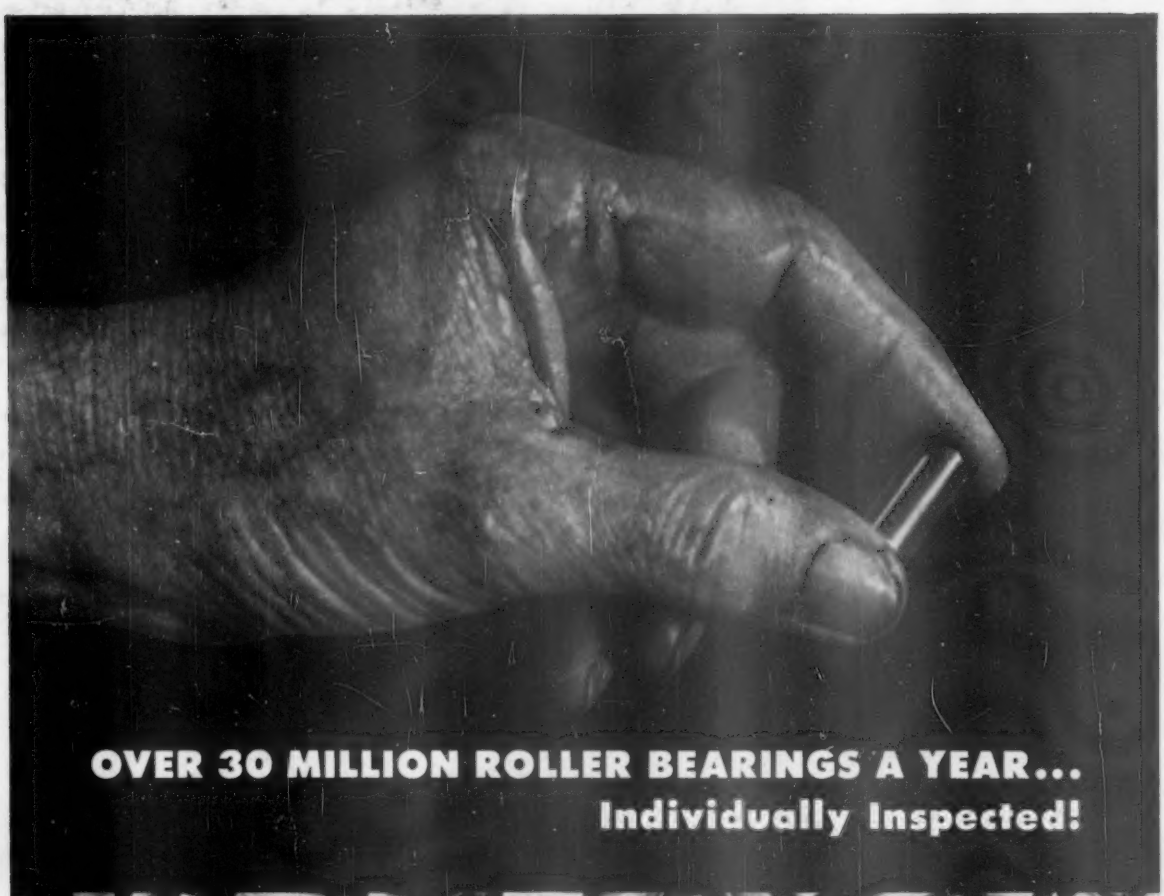
BETTER BE SAFE THAN SORRY
GUIBERSON

THE
GUIBERSON
CORPORATION

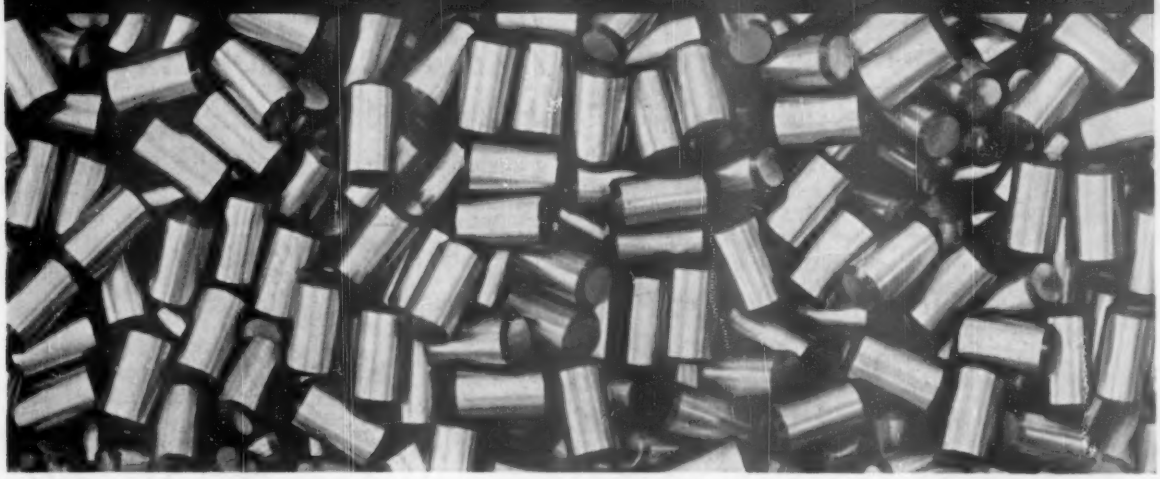
ESTABLISHED 1919
DALLAS, TEXAS
U. S. A.

ONE OF THE DRESSER INDUSTRIES

Sold by
Oil Field Supply Stores
Everywhere



OVER 30 MILLION ROLLER BEARINGS A YEAR... Individually Inspected!



One hundred per cent inspection (not batch sampling) safeguards the quality of the roller bearings that go into Hughes rock bits. Every one of the more than 30 million roller bearings manufactured each year by Hughes goes through four final inspections.

Each bearing is inspected electronically for length, diameter and hardness, and then subjected to ultra-violet light inspection for surface imperfections not detectable by the human eye.

In addition, the special analysis bearing steel—made to Hughes' specifications—must pass a series of metallurgical inspections before it is accepted. This combination of selected raw materials and finished-product inspections assures the consistent, dependable performance of HUGHES rock bits.